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**Intermountain
Research Station**

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Report INT-245

July 1988

Fire Retardant-Caused Corrosion—A 1986 Field Reassessment

Charles W. George
George A. Gehring

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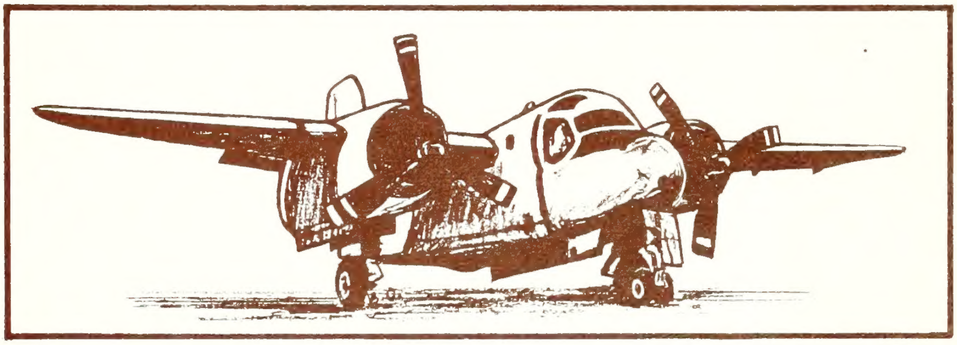

THE AUTHORS

CHARLES W. GEORGE received his B.S. degree in forest engineering in 1964 and M.S. degree in forestry in 1969. He joined Intermountain Station's staff in 1965 where he has conducted studies related to prescribed fire, pyrolysis and combustion, fire retardants, and aerial delivery systems. Presently Mr. George is project leader of the Fire Suppression research work unit at the Intermountain Fire Sciences Laboratory (formerly Northern Forest Fire Laboratory). The current mission of the work unit is to develop the knowledge and application systems needed to improve fire control capabilities, to reduce costs, and to improve chemical fire suppression technology.

GEORGE A. GEHRING, JR., graduated from Drexel University in 1966 with a degree in electrical engineering. Mr. Gehring received his M.S. degree from Drexel University in metallurgical engineering in 1969. He is an accredited corrosion specialist by the National Association of Corrosion Engineers. He joined A. V. Smith Engineering Co. in 1969; he became staff engineer for A. V. Smith Engineering Co./ Ocean City Research Corp. In 1973 he was appointed a vice president, in addition to principal investigator for research conducted by Ocean City Research Corp., Ocean City, NJ. He has been involved in field surveys of chemical firefighting equipment and operations and has conducted retardant corrosion research for the Forest Service and cooperators.

RESEARCH SUMMARY

The corrosivity of long-term wildland fire retardants delivered by airtankers has been a continuing concern since the beginning of the retardant program in 1955. During the fall of 1986, the severity of corrosion was investigated at air-attack bases in Oregon, California, and Nevada. At the 10 air bases visited, 25 different airtankers were inspected, and personnel from the bases and the contract airtanker operators were interviewed. The survey established that fire retardant corrosion of airtankers continues but the problem is not getting worse. It is recommended that wildland fire management agencies responsible for aerial fire retardant operations maintain a program to monitor the corrosivity of its approved fire retardants and corrosion problems related to their use.

Cover photo: Corrosivity of forest fire retardants, as evidenced by the color photo of an aircraft tank and gating system in the drop position, remains a serious problem among retardant bases surveyed in this report.

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** PLEASE NOTE **

INTRODUCTION

Over the past 15 years the USDA Forest Service has expended considerable effort toward reducing fire retardant-caused corrosion of airtankers used to deliver fire retardant and the equipment used to mix, store, and handle it. This effort has reduced costly equipment and hardware failures, extended the life of equipment, reduced maintenance costs, and reduced the risk of aircraft failures. Many of the corrosion control initiatives implemented by the Forest Service and other fire management agencies resulted from field surveys and laboratory studies conducted between 1973 and 1978. Because of recent changes in the chemical formulations of retardants, in 1986 the Forest Service decided to reassess the situation. As a result, the Ocean City Research Corporation was contracted to participate in a field survey of fire retardant bases in Oregon, California, and Nevada. The objectives of the survey were to: (1) assess the extent to which corrosion still persists, (2) determine whether changes in chemical formulations and equipment have affected corrosion problems, and (3) evaluate the effectiveness of initiatives implemented during the past 10 years. This report describes results of the 1986 field survey.

FOREST SERVICE CORROSION STUDIES

Corrosion of airtankers and retardant storage and mixing equipment has been considered a problem since the very beginning of the retardant program (Operation Firestop, 1955). In 1964, the Arcadia Equipment Development and Test Center (Forest Service) tested retardant formulations not containing corrosion inhibitors on several metals commonly used in airtankers (see fig. 1). The results showed that the retardants were corrosive in varying degrees, from failures within 2 days to only small pits after a year's time, depending on the retardant-metal combinations examined.

After the 1964 fire season, inspection of airtankers used to carry several different retardants revealed varying amounts of corrosion damage (see fig. 2). The degree of damage was found to be related to the type of retardant, the type of metal used in construction of the aircraft and tanks, the use of protective coatings, and the housekeeping practices of the operators. These examinations resulted in recommendations for reducing corrosion to aircraft and equipment.

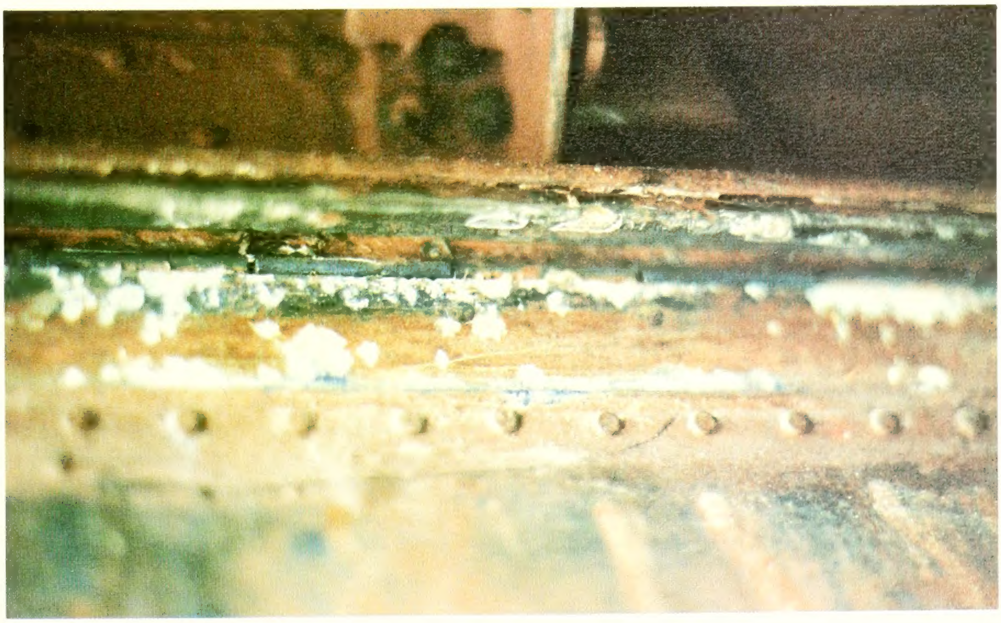

Figure 1—Pitting corrosion of aluminum tank gate.

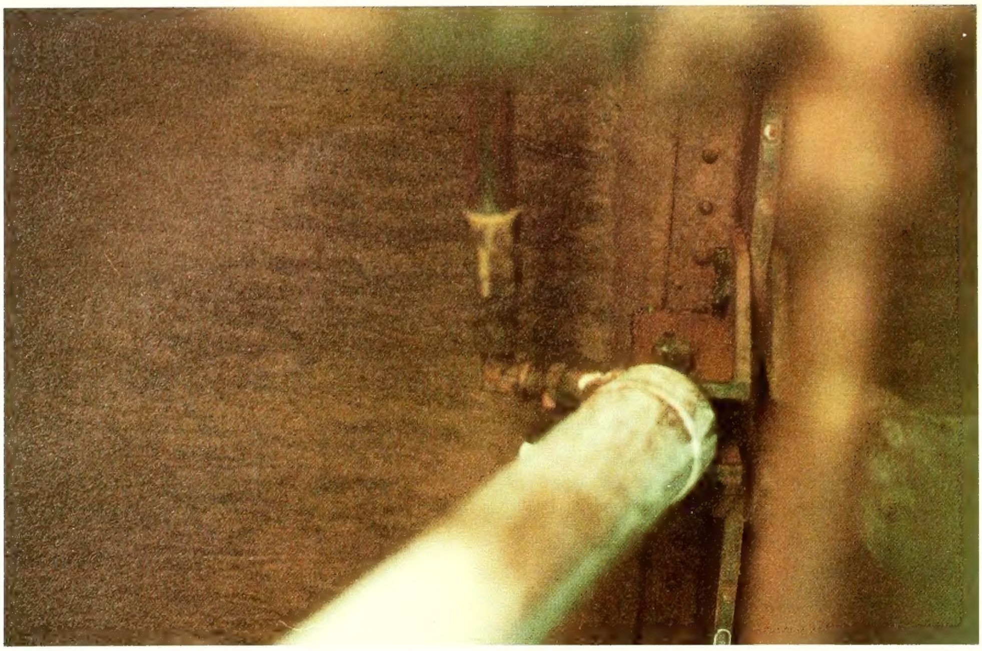

Figure 2—Corrosion of steel end fitting on Aeroquip hydraulic hoses.

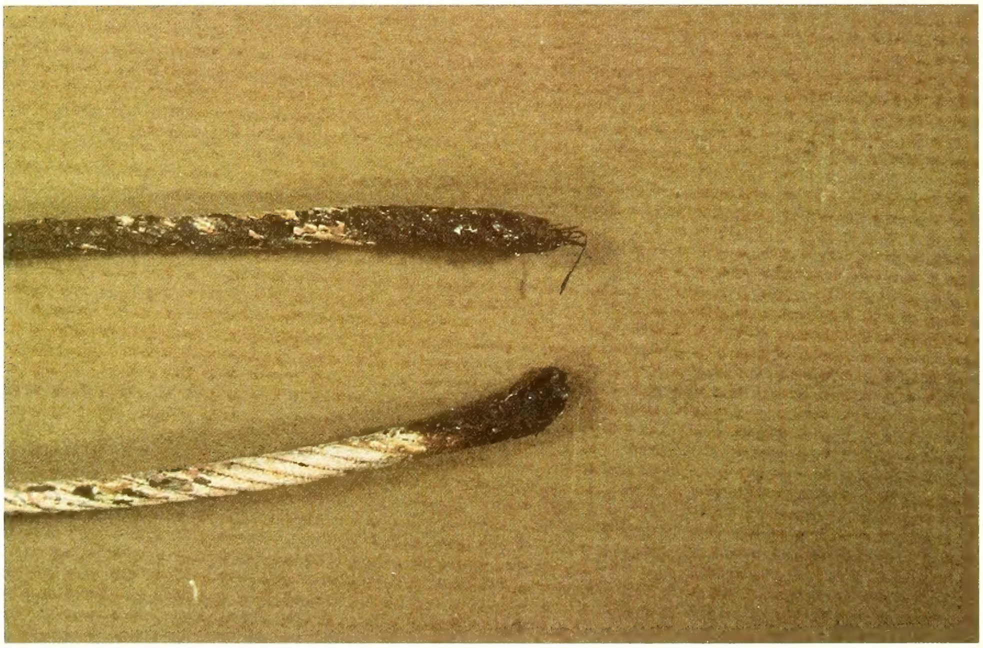

Figure 3—Failure of stranded steel cable.

Early in 1968, the San Dimas Equipment Development Center (Forest Service) conducted a variety of corrosion tests using different retardants. In 1969-70, partially as a result of this testing, the Forest Service included permissible corrosion rates in specifications for both dry and liquid retardants (interim specifications 5100-00301 and 5100-00302a).

In 1973, in an effort to obtain better insight into corrosion and appropriate methods for its control, Ocean City Research Corporation was contracted to: (1) assess the corrosive effects of retardant on mixing and delivery systems, particularly airtankers; (2) determine the corrosion rates on alloys that make up commonly exposed and

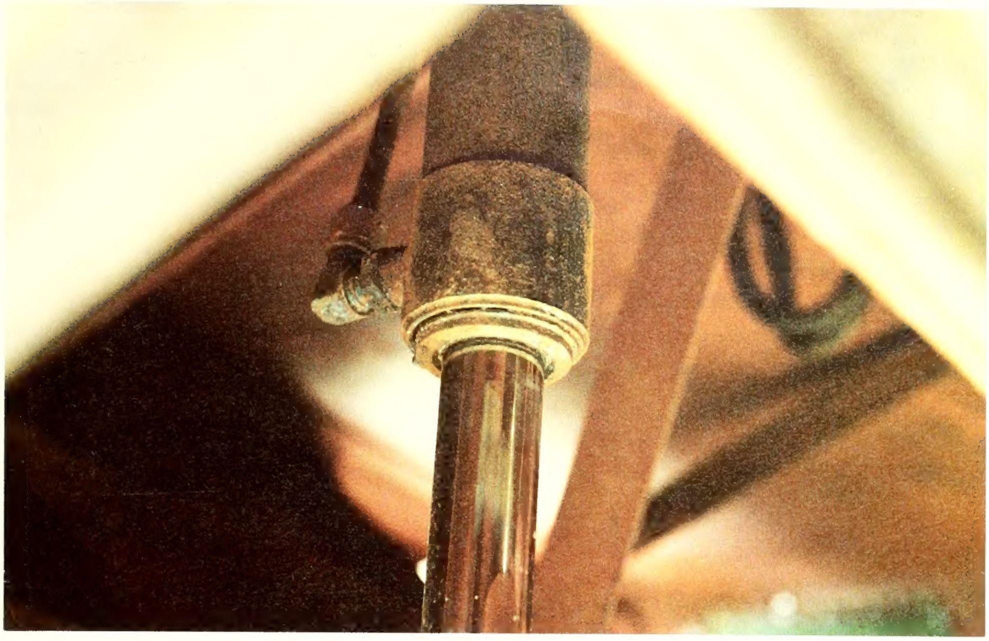

Figure 4—Corrosion of steel hydraulic piston barrel.

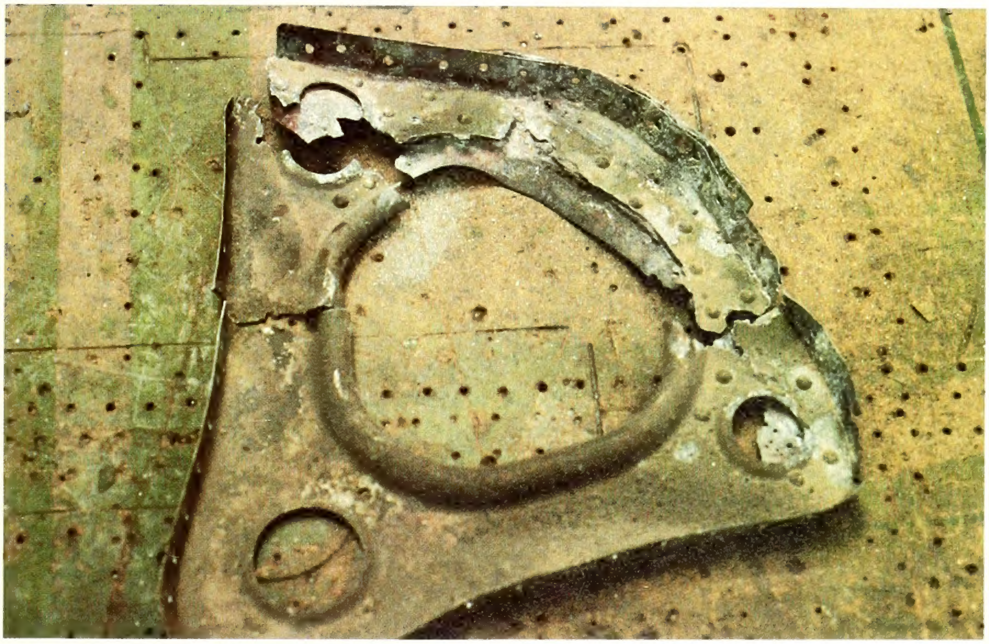

Figure 5—Corroded aluminum structural stiffener from DC-6 tail cone.

critical parts; (3) correlate these rates to actual operational damage; and (4) recommend methods for reducing corrosion.

Between 1973 and 1980, Ocean City Research Corporation conducted a comprehensive investigation of corrosion, including numerous field inspections and extensive laboratory studies. These studies resulted in three separate technical reports (see figs. 3, 4, 5). In addition, the Intermountain Fire Sciences Laboratory initiated in-house studies that have continued to the present.

THE 1986 FIELD SURVEY

Survey Team

A six-person team of fire management, equipment, and research specialists from the Forest Service, California Department of Forestry, and Ocean City Research Corporation was assembled to survey airtankers and air attack bases in Oregon, California, and Nevada in September 1986. The members of the team were:

Skip Alderson, Forest Service, Pacific Northwest Region, Fire and Aviation Management

Al Cadola, Forest Service, Pacific Northwest Region, Fire and Aviation Management

Dave Day, State of California, Department of Forestry and Fire Protection

George Gehring, Ocean City Research Corporation

Charles George, Forest Service, Intermountain Research Station

Paul Hill, Forest Service, San Dimas Technology and Development Center

Air Attack Bases and Airtanker Operators Included in Survey

During the survey, 10 air attack bases and five airtanker contractors were visited. The location of the bases, the contractors visited, and the type of retardant being used at each base at the time of the survey are identified in appendix A.

Airtankers Included in the Survey

A total of 25 airtankers were inspected during the survey. Appendix B shows the airtankers inspected, estimated time in service as an airtanker, and type of retardant primarily or recently used (as stated by the operator, aircraft pilot, or maintenance crew). The distribution of aircraft inspected according to model was as follows:

DC-4	2	S-2	7
DC-6	8	P2V	1
DC-7	4	C119	2
C-123	1		

These aircraft averaged 10.2 years service as airtankers (appendix B).

RESULTS AND DISCUSSION

Airtankers

Corrosion problems identified during the survey were either (1) observed on operational equipment or (2) observed on components that had been removed and replaced during maintenance or repair of airtankers or mixing, storage, or transfer equipment. A total of 23 separate corrosion problems were identified and are briefly described in appendix C. Of these, several are similar. Also, several of the problems are generic to a specific type of aircraft or tank and gating system. A review of the 23 corrosion problems revealed 11 basically different corrosion problems and these are illustrated in figures 6-15, as follows:

1. Pitting corrosion of aluminum tank gates and solenoids (figs. 1, 7, and 11)

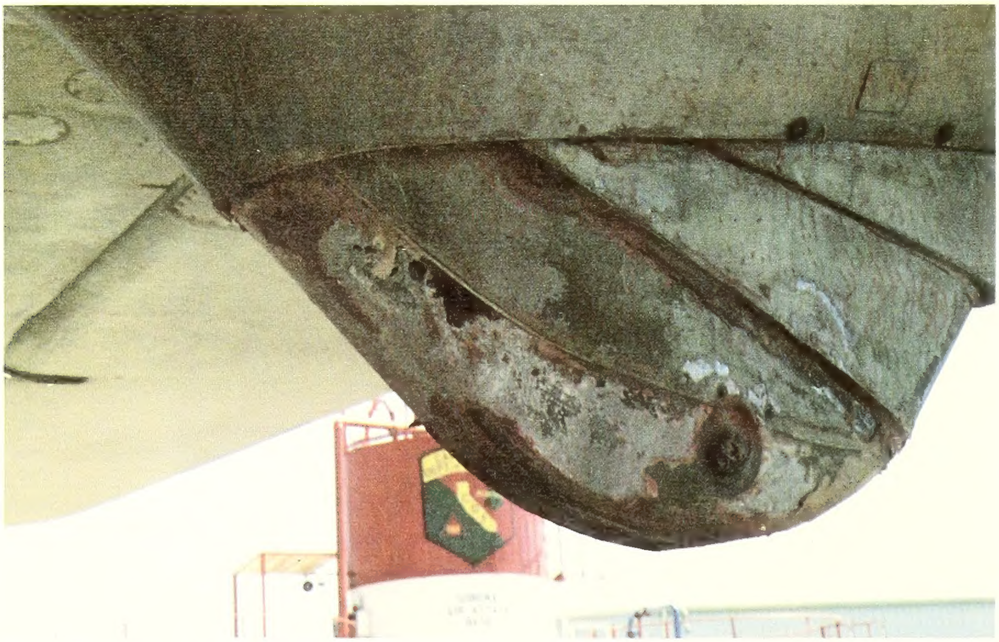

Figure 6—Corrosion of aluminum tail skid.

2. Corrosion of steel end fittings on Aeroquip hydraulic hoses (fig. 2)
3. Corrosion of stranded steel cabling (figs. 3 and 8)
4. Corrosion of steel hydraulic piston barrels and seals (figs. 4 and 12)
5. Internal corrosion of aluminum DC-6 tail cones (fig. 5)
6. Corrosion of aluminum tail skids (fig. 6)
7. Corrosion of steel rear wheel retraction pistons and cylinder pins on S-2's (figs. 9 and 10)
8. Corrosion of steel fastener hardware (figs. 13a and b)
9. Corrosion of aluminum torque arms (figs. 14a and b)
10. Corrosion of steel S-2 rear wheels and bearing races (fig. 15)
11. Corrosion of steel tank door hinges (not shown).

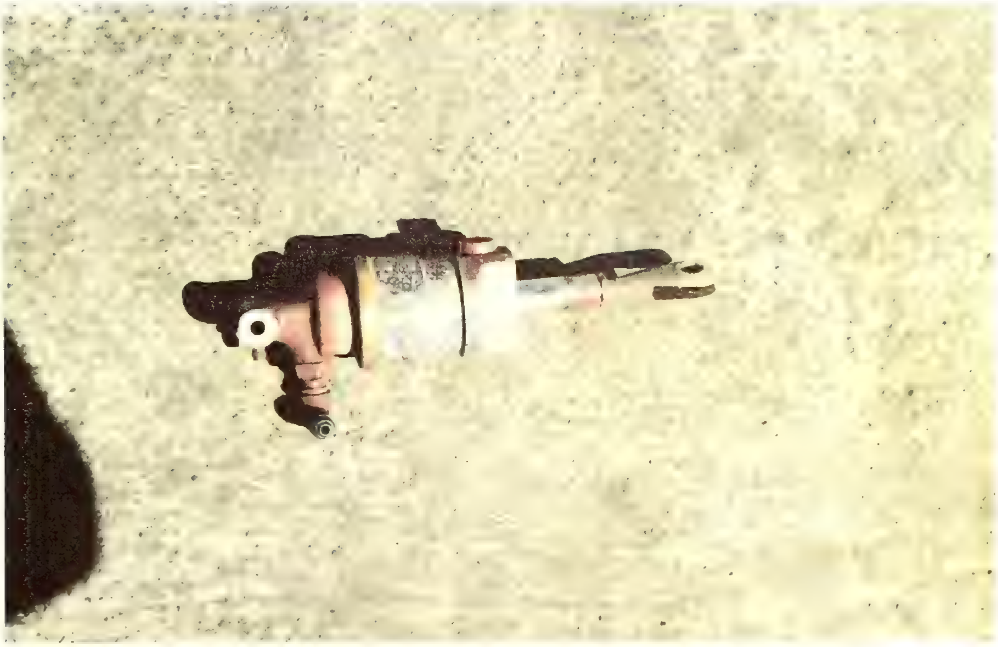

Figure 7—Corroded tank gate solenoid.

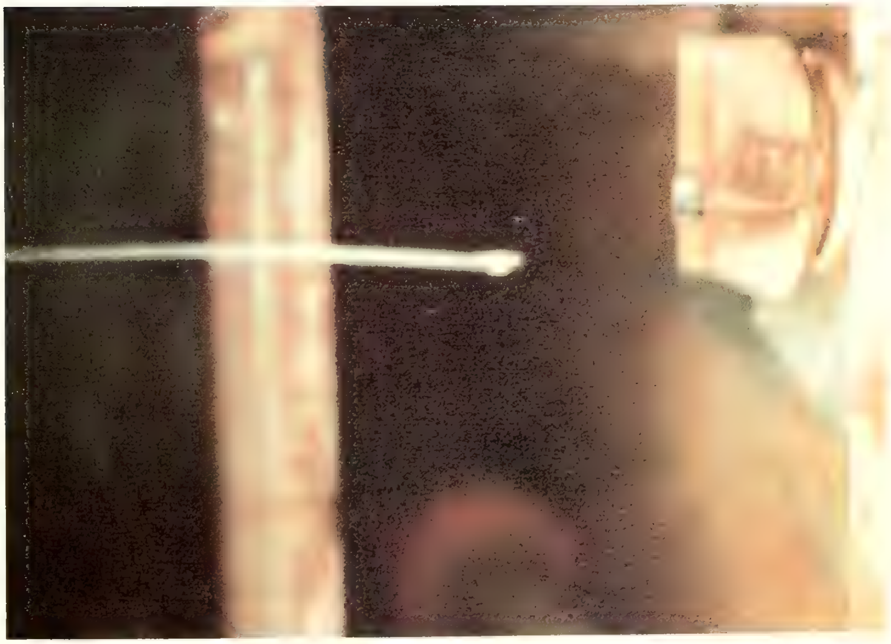

Figure 8—Broken stranded steel cable between tank equalizer flaps.

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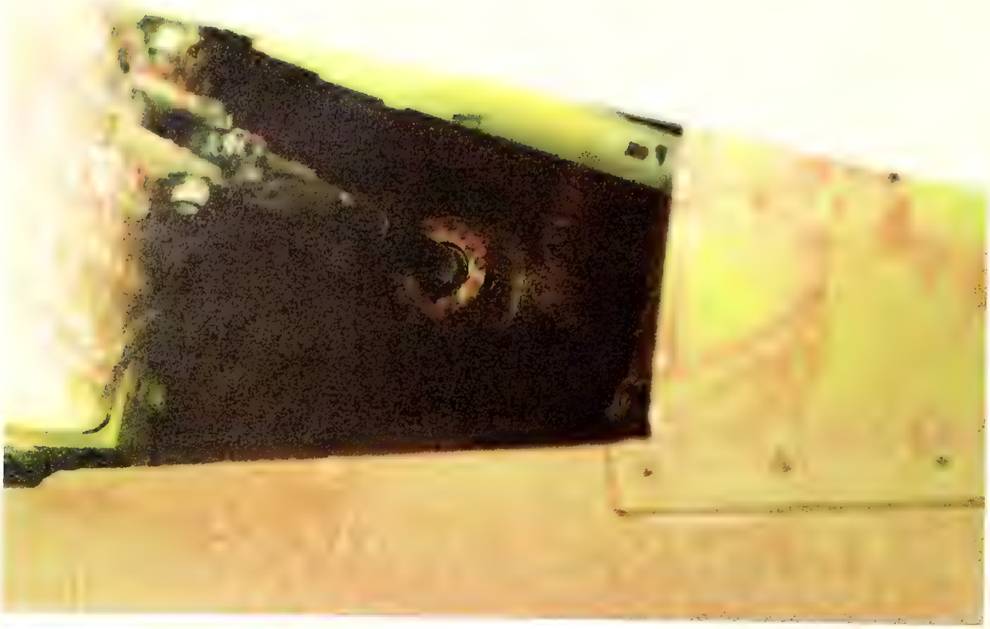

Figure 9—Corrosion of attached rear wheel retraction piston.

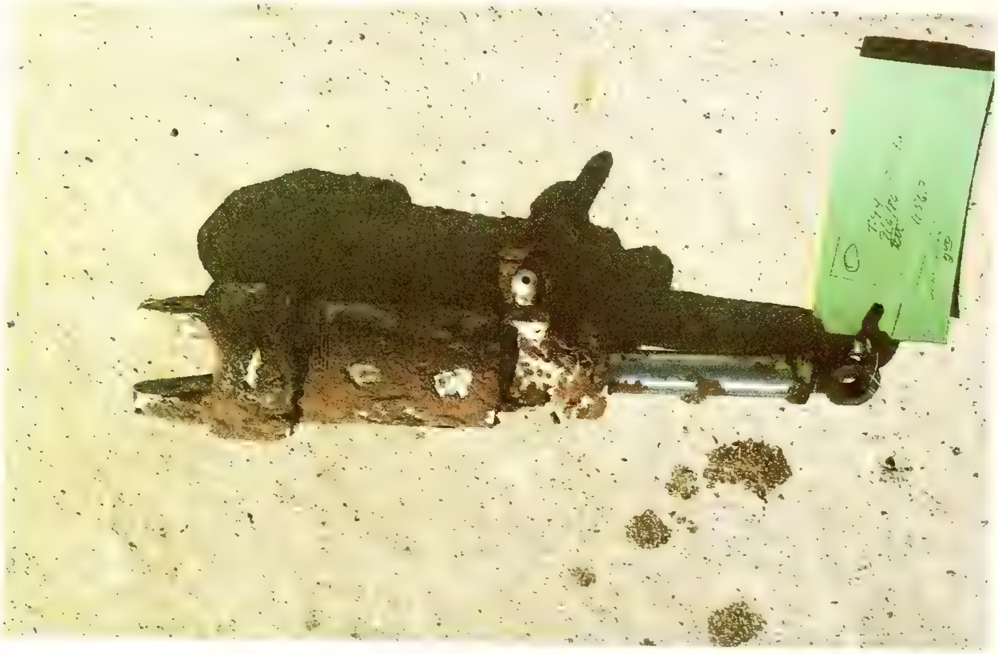

Figure 10—Corroded rear wheel retraction piston.

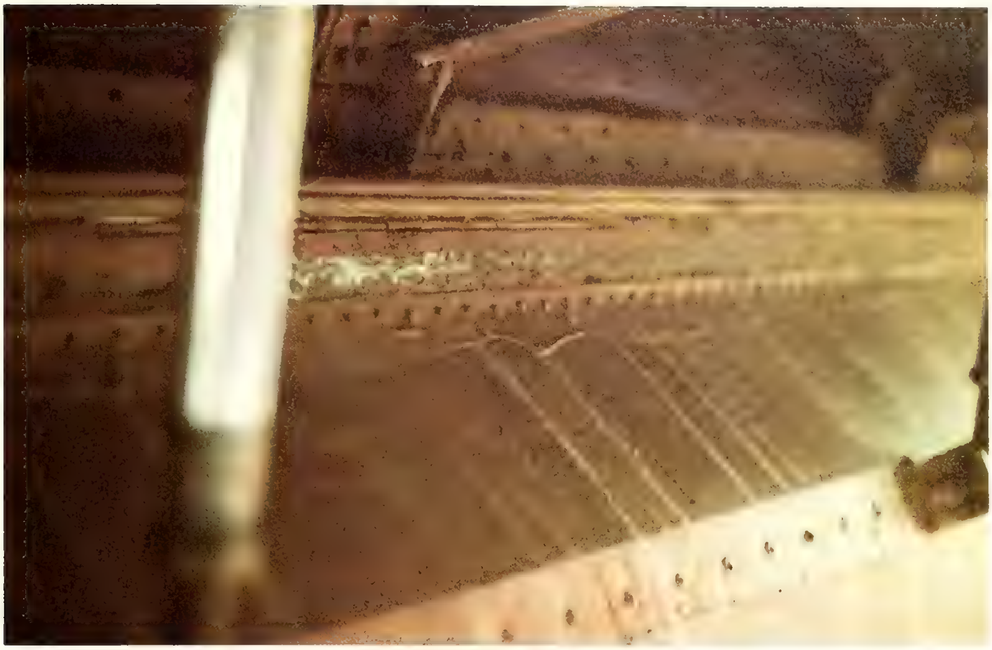

Figure 11—Pitting of aluminum tank gate.

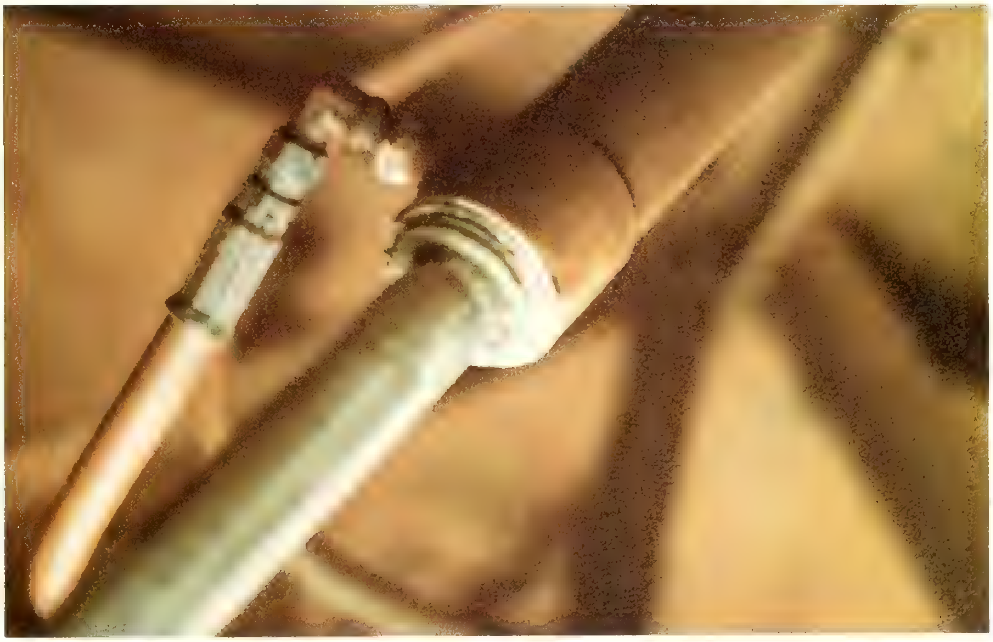

Figure 12—Corrosion of piston seal.

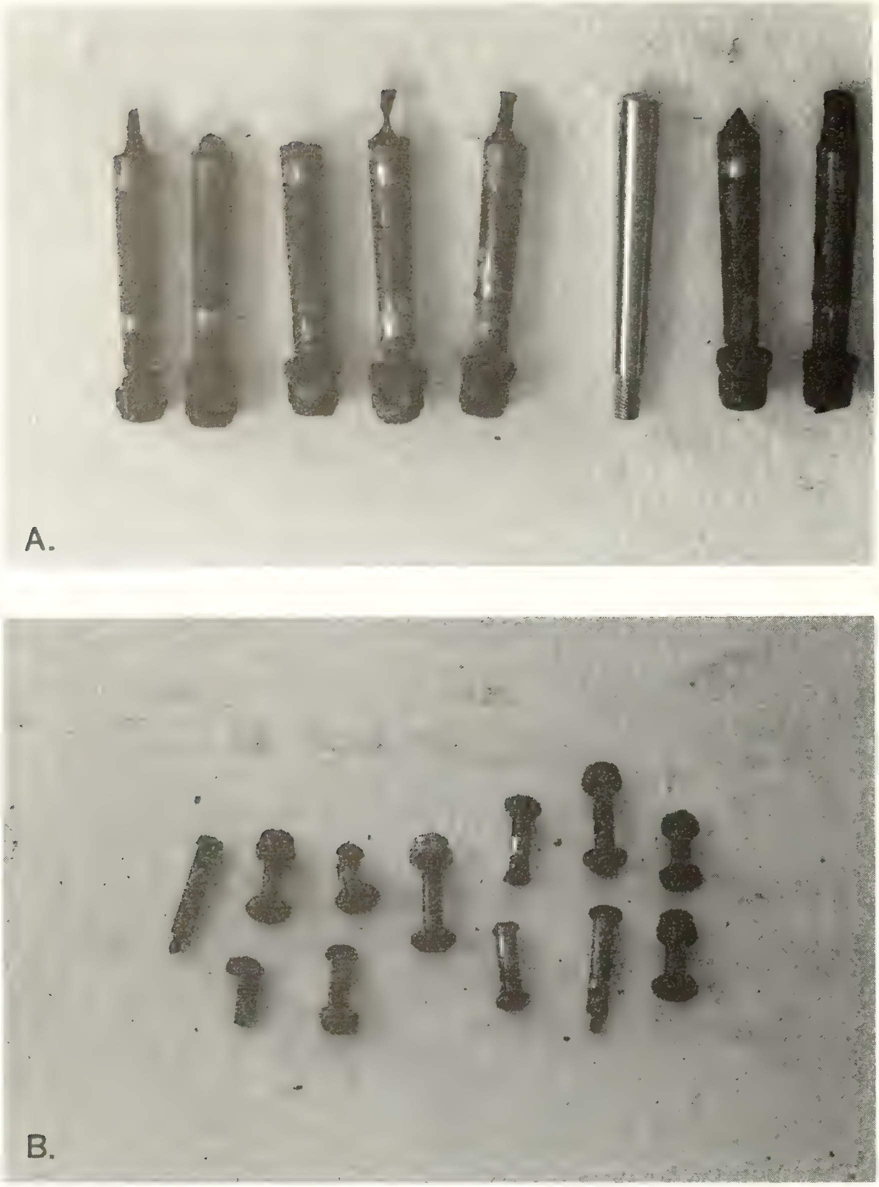

Figure 13—Corroded steel fasteners: (A) steel torque tube taper pins, (B) miscellaneous steel fasteners used in door opening assembly.

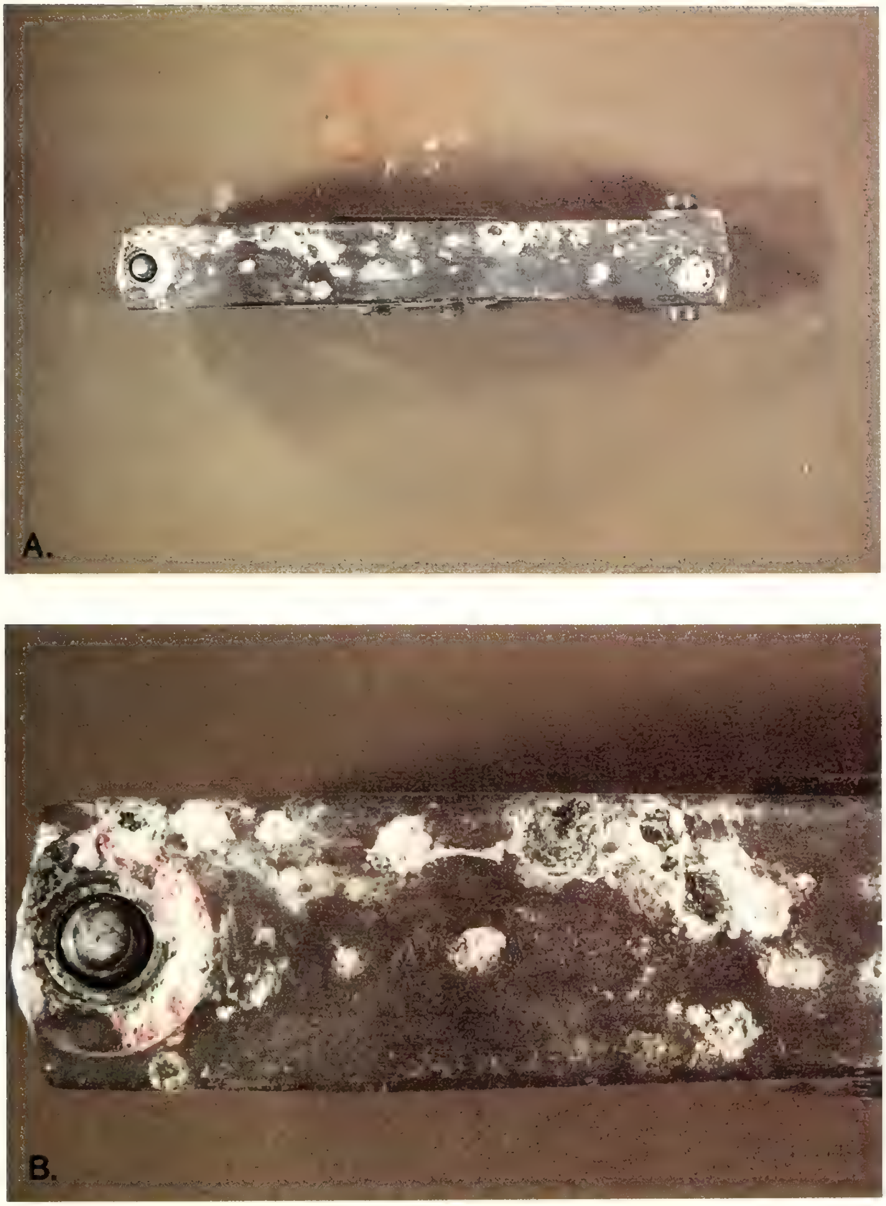

Figure 14—Corroded aluminum torque arm: (A) general view, (B) pitting at attach point.

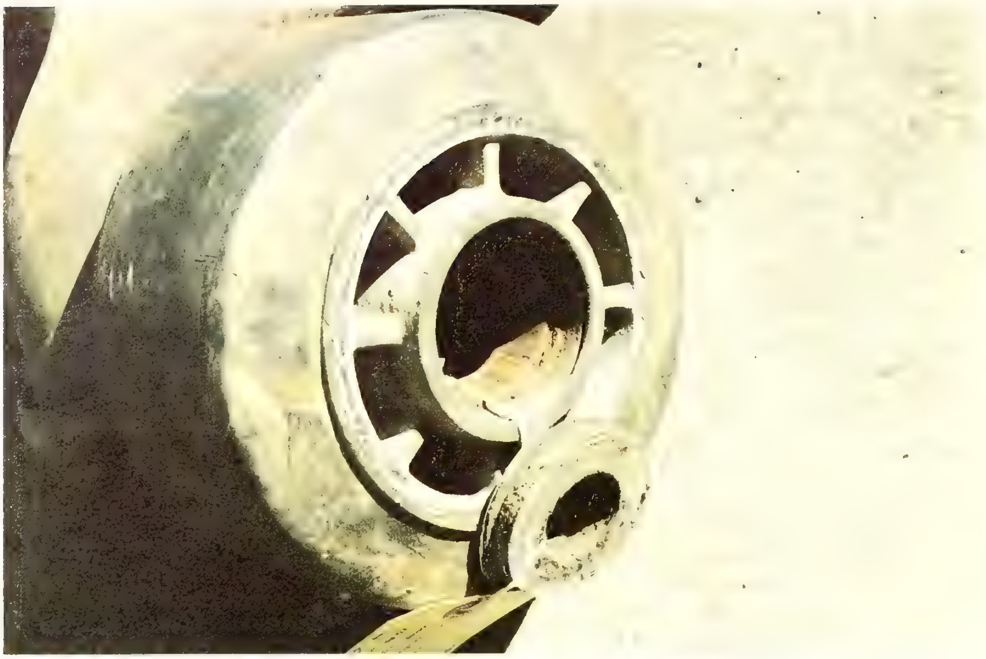

Figure 15—Corroded rear wheel removed from an S-2.

As in past field surveys, it was obvious that a wide difference of opinion exists among the people associated with airtanker operations on almost every issue related to fire retardant-caused corrosion. This includes the nature and cause of the various corrosion problems, the seriousness of the problems, and the priority for solving various problems. This diversity of opinion makes it difficult to compare the degree and extent of corrosion with what it was 10 years ago.

Some of the aircraft had seen long service having many different retardants. But because the quantities of various formulations and history of exposure had not been recorded, it was nearly impossible to correlate damage with the use of a specific retardant. Thus, it is difficult to evaluate opinions about the relative corrosivity of the different retardants. It is indisputable that corrosion problems still continue, but opinions as to their seriousness vary widely.

Many of those interviewed contended that the new formulations (Fire-Trol GTS, Phos-Chek D75) are causing corrosion problems not observed previously. Specifically noted were accelerated corrosion of exposed steel fastener hardware and steel hydraulic components in tanks and corrosion of aluminum torque arms. Given the observations of the survey team and the frequency of the complaint concerning corrosion of steel hardware exposed in tanks, it would seem that attention should be given to this particular problem. The reported rate of corrosion attack (for instance, severe necking of bolts in one fire season) appears to be much greater than would be expected from approved retardants. The Forest Service fire retardant specification requires that approved retardants corrode 4130 steel at less than 5.0 mils per year (mpy) under specified partial immersion conditions. The reported attack is far in excess of this rate. Given the small area of steel as compared to aluminum in a typical tank, the problem suggests the presence of galvanic corrosion. Based on previous laboratory studies, steel was ordinarily electrochemically less active than aluminum and, thus, would not be expected to galvanically corrode when coupled to aluminum. But there were exceptions—specifically, in Fire-Trol 100, an ammonium sulfate-type retardant. (Both new formulations, Fire-Trol GTS and Phos-Chek D75 are ammonium sulfate-based retardants.) Thus, there is a need to investigate the propensity for galvanic corrosion between steel and aluminum in the new retardant formulations.

Some of the above problems can be solved without modifying the chemical corrosivity of the approved retardants. For example, corrosion of steel fastener hardware in aircraft tanks was mitigated in several airtankers by the judicious use of protective coatings/sealants or the substitution of stainless steel. At a certain point further modification of the retardant formulations to reduce corrosivity will prove less cost effective than other measures (for example, use of protective coatings, substitution of more resistant alloys). Some of those measures have been described in the recent publication "Guidelines for Preventing Fire Retardant Corrosion" (fig. 6).

Mixing Plants

Corrosion of mixing plants is far less of a problem than it was 10 years ago. This is partly due to new designs in retardant mixing systems. Also, the replacement of Fire-Trol 100, known to be highly corrosive to steel, with Fire-Trol 931L, LCA, and more recently Fire-Trol GTS, all meeting the more restrictive uniform corrosion requirements (especially partial corrosion of steel) has reduced corrosion commonly observed on steel. Finally, mixing plant operators are now more knowledgeable about corrosion and prevention methods.

There were a few exceptions to the general findings at mixing plants. Accelerated corrosion penetration of steel storage tanks was reported at a few plants (Santa Rosa, Chico). The corrosion (pitting tendency) was associated with Phos-Chek A (a monoammonium phosphate-based retardant), which has since been replaced and is no longer available. Laboratory studies and consultation with experts suggested that the corrosion was biologically induced. Future reports of such damage should be monitored by fire management agencies to determine whether this type of corrosion remains a problem.

Other Problems

Related problems noted during the survey include cracking of the rubber hydraulic hoses in the tanks and disbondment/peeling of certain protective paints and sealants applied to tanks (both airtankers and mixing plants). The tanks of several aircraft had been coated with epoxy. Inspection showed that this type of coating is effective for protecting both the tank and its internal parts.

CONCLUSIONS

1. Airtankers and mixing plants continue to suffer corrosion from fire retardants. Assessment of present-day severity versus that of 10 years ago is difficult. Field personnel differ on this point, and lack of documentation makes it difficult to correlate observed damage to the use of specific retardants. There is no overwhelming evidence that corrosion has grown significantly worse, although in several instances (with respect to exposure to steel and aluminum) corrosion damage was greater than expected.
2. The current rate of corrosion to airtankers and mixing plants is severe enough to warrant further research into its causes and how to mitigate it, and a continued program of periodic inspections.
3. New formulations may have increased the propensity for steel to corrode when coupled to aluminum.
4. Application of existing guidelines for preventing fire retardant-caused corrosion can be effective.

RECOMMENDATIONS

1. The Forest Service should maintain a program to continually assess the corrosivity of approved retardants and corrosion problems related to their use. This should include assessment of the permissible rates of corrosion (methods and procedures, alloys, type of corrosion, exposures, etc.).
2. New retardant formulations (Fire-Trol GTS, Phos-Chek D75) should be studied to determine effect on galvanic corrosion between steel and aluminum.
3. Implementation of Forest Service guidelines for preventing or minimizing fire retardant-caused corrosion should receive maximum emphasis.

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APPENDIX A: AIR ATTACK BASES AND CONTRACTORS INCLUDED IN SURVEY

Air Attack Bases

Location	Type of Fire Retardant[1]
Chico, CA	Phos-Chek D75
Fresno, CA	Phos-Chek D75
Hollister, CA	Fire-Trol GTS
Klamath Falls, OR	Fire-Trol LCA
Medford, OR	Fire-Trol GTS
Minden, NV	Fire-Trol 100
Redding, CA	Fire-Trol GTS
Redmond, OR	Fire-Trol GTS
Santa Rosa, CA	Phos-Chek D75
Stockton, CA	Phos-Chek D75

Airtanker Operators[2]

Firm	Location
Aero Union Corporation	Chico, CA
Butler Aviation	Redmond, OR
Hemet Valley Aviation	Stockton, CA
Macavia International	Santa Rosa, CA
TBM Incorporated	Tulare, CA

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[1] Retardant being used at the time the survey was conducted (September 1986).

[2] Airtanker operators surveyed included owner/operators in addition to those visited (see appendix B).

APPENDIX B: AIRTANKERS INCLUDED IN SURVEY

	Identification[1]					
Type	Airtanker	No.	Owner	Location	Estimated years service	Comments on retardant use[2]
DC-4	N111712	02	Aero Union	Fresno	10	PC-D75 recently
DC-4	N2742G	15	Aero Union	Fresno	3	PC-D75 recently
DC-4	N42185	18	Aero Union	Redding	3	FT 100, GTS 1986, all retardants previously
DC-6	N90MA	21	Macavia	Sonoma	12	Mostly FT 931, PC-D75 (1986) FT (1985)
DC-6	N444SO	44	Macavia	Medford	11	FT-GTS 1986, FT 931 previous season
DC-6	N555SO	45	Macavia	Klamath Falls	15	FT 931, FT-GTS, PC-D75 recently
DC-6	N111AN	46	Macavia	Sonoma	14	Mostly FT 931 in recent years, some GTS in 1985
DC-6	N666SO	47	Macavia	Chico	15	PC-D75 1985, all previously
DC-7	N838D	60	TBM	Fresno	10	FT-GTS, PC-D75 recently
DC-7	N848	61	TBM	Fresno	6	PC-D75 recently
C-123	N3142D	63	TBM	Fresno	3	PC-D75 (2 years)
DC-7	N6353C	66	Butler	Redmond	10	All retardants
DC-7	N6318C	67	Butler	Redmond	12	FT-GTS 1986, FT 931 previous season
S-2	N412DF	72	CDF	Chico	11	All retardants except FT 931
S-2	N406DF	73	CDF	Redding	14	FT-GTS 1986, PC-D75 previous season
C-119	N13743	81	Hemet Valley	Minden	9	PC-D75, FT 100, FT 931
C-119	N13744	86	Hemet Valley	Redding	20	FT-GTS last 2 years
S-2	N450DF	90	CDF	Sonoma	12	Mostly PC-D75 last few years
S-2	N453DF	91	CDF	Sonoma	12	Mostly PC-D75 last few years
S-2	N452DF	92	CDF	Sonoma	12	Mostly PC
S-2	447DF	93	CDF	Hollister	12	FT-GTS last 2 years
DC-6	N90739	97	TBM	Minden	11	PC-D75, FT-GTS, FT 100, FT 931
S-2	N436DF	100	CDF	Fresno	8	PC-D75 recently
P2V	N202EV	141	Evergreen	Chico	8	FT 931 (1986)
DC-4	N90203	166	Hemet Valley	Sonoma	3	PC-D75 (1986), FT 931 (1986)

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[1] The airtanker number is that number assigned by the Interagency Airtanker Board and displayed on the tail of all airtankers.

[2] History of exposure of airtankers to specific retardants is difficult to define since airtankers carry most all retardant types and are moved to different bases throughout the season. Comments by pilots or operators about primary exposure the last few seasons are noted.

APPENDIX C: CORROSION PROBLEMS NOTED DURING SURVEY

No.	Problem	Description	Source	Ref. fig.	Other remarks
1	Pitting corrosion of aluminum tank gates.	Deep pits (up to 1/8-inch) observed on tank gating (believed to be 7075 Al).	DC-6 (N444SO) T44	1	Pilot believes attack in tank gates occurred this season hauling FT-GTS.
2	Corrosion of steel end fittings on Aeroquip hydraulic hoses.	Rusting and general surface corrosion observed on end fittings.	DC-6 (N444SO) T44	2	
3	Failure of stranded steel cable between tank equalizer flaps.	Cable exhibits significant corrosion of strands —indicating corrosion contributed to failure.	S-2 (N406DF) T73	3	
4	Corrosion of steel hydraulic piston barrels.	General surface corrosion and pitting of steel piston barrels on tank gating hydraulics.	DC-6 (N90MA) T21	4	Mechanic reports that this has been a common problem—piston barrels have been overhauled and painted on some aircraft.
5	Corrosion of steel end fittings on Aeroquip hydraulic hoses.	Same as 2.	DC-6 (N90MA) T21	4	Mechanic also reports this to be a common problem.
6	Corrosion of steel fastener hardware in tanks.	General surface rusting and pitting of tank fasteners.	Reported by aircraft mechanic at Sonoma.	—	Mechanic advises that all fastener hardware now coated with 3M EC800 (rubber sealant).
7	Internal corrosion of tail cone on DC-6's.	General surface corrosion of aluminum stiffeners and fuselage in the tail cone.	Reported by aircraft mechanic at Sonoma—corroded parts inspected in maintenance shop.	5	Mechanic advises that retardant seeps through access plate in the tail cone, builds up, and causes corrosion.
8	Corrosion of cast aluminum tail skid.	Extensive corrosion and deep pitting (including penetration observed on cast aluminum tail skid).	DC-4 (N90203) T166	6	
9	Corrosion of tank gate solenoids and attaching hardware.	Corrosion of tank gate solenoids and attaching bolts observed underneath front and rear fairings.	DC-4 (N90203) T166	7	
10	Broken cable between tank equalizer flaps.	Corrosion observed on broken stranded steel cable—appears to have contributed to failure.	S-2 (N452DF)	8	
11	Corrosion of rear wheel retraction piston.	Surface corrosion observed on rear wheel retraction piston.	S-2 (N436DF) T100	9	
12	Corrosion pitting on tail skid.	Pitting observed on tail skid.	DC-4 (N11712) T02		
13	Corrosion pitting on tail skid.	Same as 12.	DC-4 (N2742G) T15	—	

(con.)

APPENDIX C (Con.)

No.	Problem	Description	Source	Ref. fig.	Other remarks
14	Corrosion failure of tank door hinges.	Hinge suffered extensive corrosion.	Reported by aircraft mechanic at Klamath Falls.	—	Lost two doors when dropping load; all doors and hinges to be overhauled during winter.
15	Corrosion of rear wheel retraction piston.	Same as 11.	Reported by aircraft mechanic at Hollister.	10	Mechanic advised retardant enters breather hole in piston and corrodes internals.
16	Pitting of tank gates.	Deep pitting observed beneath blue film formed on tank door.	DC-6 (N555SQ) T45	11	Pitting attack on gate varies significantly depending on location.
17	Corrosion of piston seals.	Significant corrosion observed on piston seals on tank gate hydraulic system.	DC-6 (N555SQ)	12	Aircraft mechanic advises that replacement of piston seals due to corrosion is a continual problem.
18	Corrosion of steel fastener hardware.	Severe corrosion (necking of bolts) reportedly occurred on fastener hardware used to hold tank in aircraft. Corrosion also noted on torque tube pins.	Reported by representatives of contract airtanker operator.	13a,b	Representatives of contract airtanker operator advise corrosion occurred in one fire season using FT-GTS.
19	Corrosion of torque arms.	Corrosion attack (pitting) observed on aluminum (Tenzaloy) torque arms.	Reported by representatives of contract airtanker operator.	14a,b	Representatives of contract airtanker operator advise corrosion occurred in one fire season (3 mos) in PC-D75 with aircraft sitting loaded.
20	Corrosion of steel bolt heads.	Corrosion attack reported on bolt heads in several tanks.	Reported by representatives of contract airtanker operator.	—	Reported as problem occurring only in recent years.
21	Corrosion of rear wheel retraction piston.	Same as 11.	Reported by representatives of contract airtanker operator	—	Airtanker operator advised continued problem on S-2 rear wheels; rear piston had to be replaced after 118 hours because of corroded cylinder seal.
22	Corrosion of rear wheels.	Surface corrosion of rear wheel bearing races.	Reported by representatives of contract airtanker operator	15	Airtanker operator advised rear wheels have to be replaced every 1-2 years because of corrosion of bearing races.
23	Corrosion of steel fastener hardware.	Steel bolts reportedly severely necked down after 5 years on S-2 (tanker #70).	Reported by representatives of contract airtanker operator.	—	Airtanker stationed at Sonoma and carried mostly PC.

U.S. GOVERNMENT PRINTING OFFICE: 1988—575-750/M-8484 REGION NO. 8

George, Charles W.; Gehring, George A., Jr. 1988. Fire retardant-caused corrosion—a 1986 field reassessment. Gen. Tech. Rep. INT-245. Ogden, UT: U.S.Department of Agriculture, Forest Service, Intermountain Research Station. 15 p.

In 1986, selected air attack bases in the Western United States were inspected to reassess the threat of fire retardant-caused corrosion to aircraft and retardant-mixing equipment. Conclusions were that the corrosion problems had not worsened during the previous 10 years but remained serious enough to warrant continued monitoring, additional emphasis on prevention guidelines, and further research—particularly into the possibility that new retardant formulations are accelerating galvanic corrosion where aluminum joins steel.

KEYWORDS: alloys, mixing plants, guidelines, coatings, maintenance, survey, wildland fires, aircraft corrosion, chemical retardants, corrosion prevention, galvanic corrosion, retardant specifications

INTERMOUNTAIN RESEARCH STATION

The Intermountain Research Station provides scientific knowledge and technology to improve management, protection, and use of the forests and rangelands of the Intermountain West. Research is designed to meet the needs of National Forest managers, Federal and State agencies, industry, academic institutions, public and private organizations, and individuals. Results of research are made available through publications, symposia, workshops, training sessions, and personal contacts.

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United States
Department of
Agriculture

Forest Service

**Intermountain
Research Station**

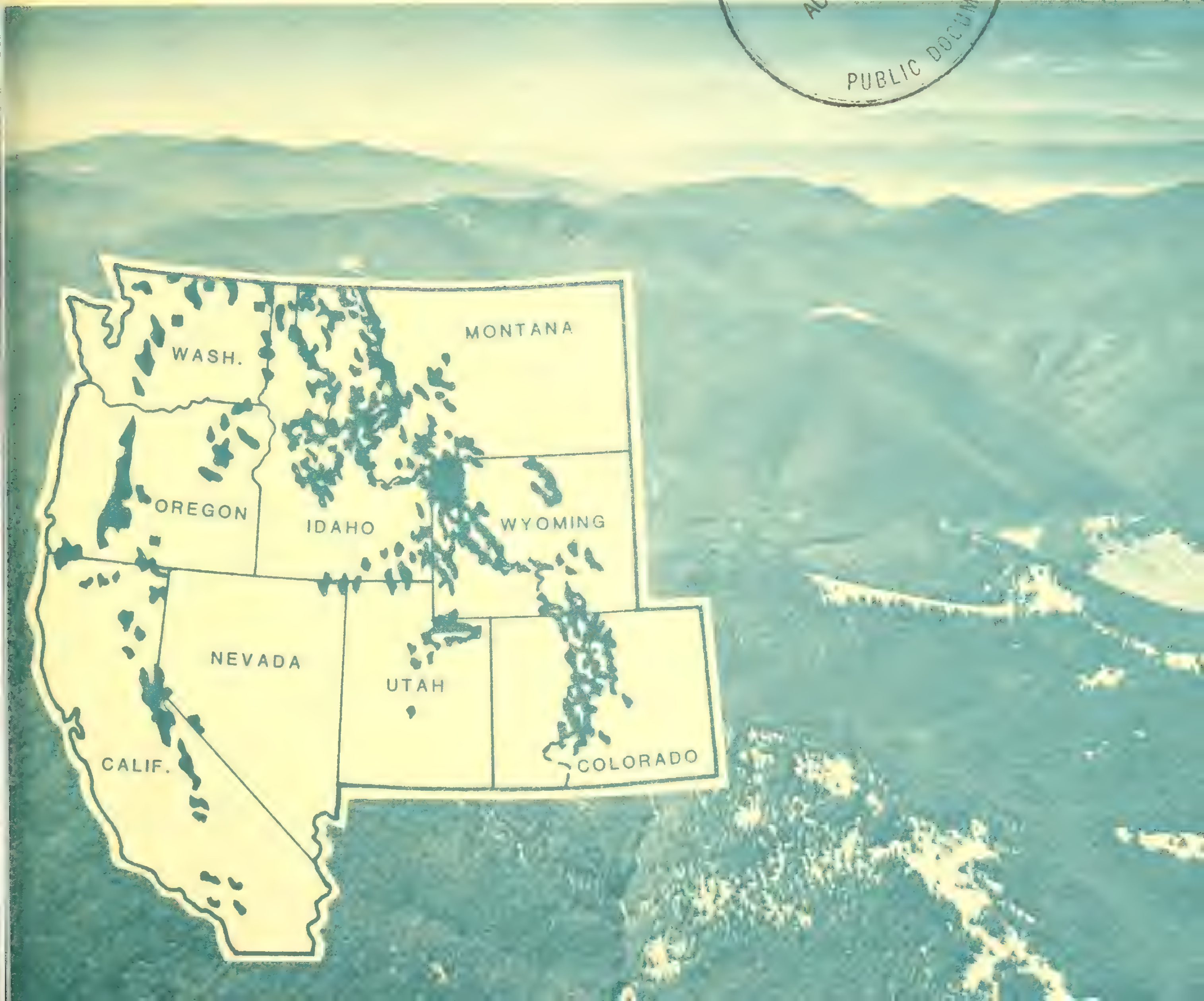
General Technical
Report INT-246

June 1988

Atlas of 28 Selected Commercial Forest Areas With Unutilized Stands of Lodgepole Pine

Peter Koch
Roland L. Barger

CLEMSON UNIVERSITY
AUG 17 1988
PUBLIC DOCUMENTS



METRIC CONVERSION FACTORS

English units to metric			Metric units to English		
		LENGTH			
1 in	=	25.4 mm (exactly)	1 mm	=	0.0393701 in
1 in	=	2.54 cm (exactly)	1 cm	=	0.393701 in
1 ft	=	0.3048 m (exactly)	1 m	=	3.28084 ft
1 yd	=	0.9144 m (exactly)	1 m	=	1.09361 yd
1 chain (22 yd)	=	20.1168 m (exactly)	1 m	=	0.0497097 chain
1 mi	=	1.60934 km	1 km	=	0.621371 mi
		AREA			
1 in^2	=	645.16 mm^2 (exactly)	1 mm^2	=	0.0015500 in^2
1 in^2	=	6.4516 cm^2 (exactly)	1 cm^2	=	0.15500 in^2
1 ft^2	=	0.0929030 m^2	1 m^2	=	10.7639 in^2
1 yd^2	=	0.836127 m^2	1 m^2	=	1.19599 yd^2
1 mil-acre	=	4.04686 m^2	1 m^2	=	0.247105 mil-acre
1 acre	=	0.404686 ha	1 ha	=	2.47105 acres
1 mi^2	=	2.58999 km^2	1 km^2	=	0.386102 mi^2
		VOLUME OR CAPACITY			
1 in^3	=	16,387.064 mm^3	1 mm^3	=	0.000061024 in^3
1 in^3	=	16.38706 cm^3	1 cm^3	=	0.061024 in^3
1 ft^3	=	0.0283168 m^3	1 m^3	=	35.3147 ft^3
1 yd^3	=	0.764555 m^3	1 m^3	=	1.30795 yd^3
1 cunit (100 ft^3 of solid wood)	=	2.83168 m^3	1 m^3	=	0.353147 cunit
1 cord (128 stacked ft^3)	=	3.62456 m^3 (stacked)	1 m^3 (stacked)	=	0.275896 cord
1 bd ft	=	0.002359738 m^3	1 m^3	=	423.7759 bd ft
1 gal (US)	=	3.785412 L	1 L	=	0.264172 gal (US)
		MASS OR WEIGHT			
1 grain	=	0.064799 g	1 g	=	15.4324 grains
1 oz	=	28.3495 g	1 g	=	0.035274 oz
1 lb	=	0.453592 kg	1 kg	=	2.20462 lb
1 ton (short)	=	907.1847 kg	1 kg	=	0.0011023 ton (short)
1 ton (short)	=	.907185 t	1 t	=	1.10231 tons (short)
1 ton (long)	=	1.01605 t	1 t	=	0.98420 ton (long)
		PRESSURE			
1 lb f/in^2	=	6.8966 k Pa	1 k Pa	=	0.1450 lb f/in^2
		RATIOS			
1 ft^2/acre	=	0.229568 m^2/ha	1 m^2/ha	=	4.35600 ft^2/acre
1 ft^3/acre	=	0.0699725 m^3/ha	1 m^3/ha	=	14.2913 ft^3/acre
1 cord/acre	=	8.95647 m^3 (stacked)/ha	1 m^3 (stacked)/ha	=	0.111651 cord/acre
1 lb/ft^3	=	16.0185 kg/m^3	1 kg/m^3	=	0.0624280 lb/ft^3
1 ton (short)/acre	=	2.24170 t/ha	1 t/ha	=	0.446090 ton (short)/acre
1 mi/gal (US)	=	0.425143 km/L	1 km/L	=	2.35215 mi/gal (US)

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The authors acknowledge with appreciation the generous cooperation of the managers of the 28 forest areas studied.

RESEARCH SUMMARY

This atlas provides maps and general descriptions of a single representative problem area of more-or-less contiguous acreage within each of 28 public forests (National, Bureau of Land Management, and State) where increased utilization of lodgepole pine is desired by the forest manager. The 28 areas total 646,401 acres. Most of the lodgepole pine volume is of subsawlog size.

The managers of these areas face the problem of how to clearcut and regenerate large acreages of stagnated or otherwise unproductive stands of lodgepole pine without expenditure of public funds to cover the direct costs. Additionally, managers must accomplish this stand replacement according to a management plan without jeopardizing the other values of the forest—that is, wildlife habitat, stream quality, and esthetic quality.

Gross characteristics of a pair of trees 3½ to 4 inches in d.b.h. sampled from each area are presented. The sample trees averaged 87 years of age, about 35 feet in height, and had an average crown ratio of about 46 percent. Height from stump top to base of the live crown averaged 228 inches and below-crown stem taper (inside bark) averaged 0.60 inch/100 inches. Stem sections sampled at 20 percent of tree height, lathe-turned to 2¼ inches in diameter, and air dried had mechanical properties in compression parallel to the grain as follows (values adjusted to a moisture content of 10 percent of ovendry weight): modulus of elasticity, 1,190,000 lb f/in^2; maximum crushing strength, 5,760 lb f/in^2; proportional limit, 3,850 lb f/in^2. At 20 percent of stem height, stemwood moisture content averaged 95 percent of ovendry weight, and stemwood specific gravity averaged 0.42 based on ovendry weight and green volume. Among specimens drawn from the seven States in the study, Montana specimens had highest mechanical properties.

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CHAPTER 1: GENERAL INFORMATION

INTRODUCTION

Lodgepole pine (principally *Pinus contorta* var. *latifolia* Engelm.) occupies about 13 million acres of commercial forest land in the United States—mostly in the Intermountain West (fig. 1-1). Much of this resource is in older (60 to 200 years), virtually stagnated stands in which growth rate is very slow and mortality very high. Insect and disease attacks on lodgepole of sawlog size make growing large-diameter trees a difficult and uncertain undertaking. More than half the lodgepole pine stemwood cubic volume in the Intermountain West is in trees of subsawlog size. About one-third of the volume is on slopes exceeding 45 percent, and many of the stands are not accessible from existing logging roads.

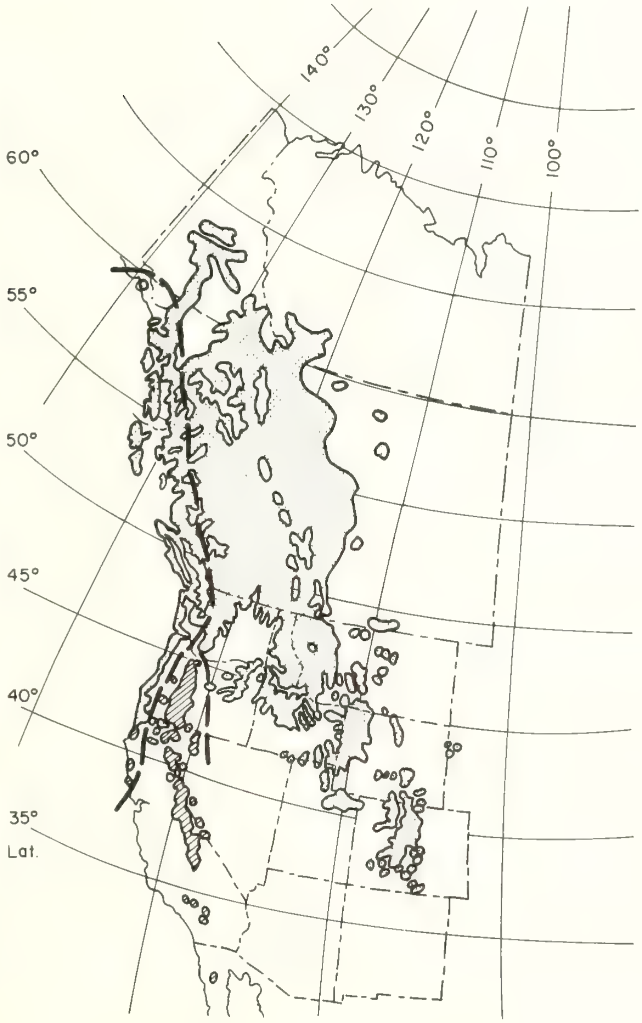

Figure 1-1—Range map of lodgepole pine in North America (Little 1971). Variety *latifolia* is mapped to the right of the dashed lines, variety *murrayana* (Grev. & Balf.) Engelm. between them, and variety *contorta* to the left of them.

In the Interior West, lodgepole pine represents the single most significant opportunity for improving both wood resource utilization and forest land management. Two concerns have focused increasing attention on improving harvesting and utilization opportunities in these stands. The first is a concern about our continuing ability to meet national demands for wood and wood-based products, especially softwood construction materials. Predictions forecast a growing gap between supply and demand, a situation that can be partially circumvented by placing currently untreated timberlands under more intensive management. Overmature and stagnated lodgepole pine occupies millions of acres of commercial forest land that will remain essentially nonproductive until present stands are harvested. A second concern is the need to achieve broad resource management and objectives relating to protection from insect, disease, and fire. Particularly urgent is the need to implement management strategies that will reduce the probability of mountain pine beetle epidemics in the future.

Silvicultural treatments (thinning or removal and regeneration to managed stands with controlled stocking) are so expensive, and stumpage revenues so little, much of the acreage has received no treatment to accelerate growth and to slow mortality. Present lack of technically and economically viable utilization alternatives precludes profitable harvest of lodgepole pine in quantities sufficiently large to effectively manage the acreage they occupy. The primary problem, therefore, is to invent processes that will permit large-scale profitable utilization of lodgepole pine of all diameter classes on all terrains, and to effectively disseminate information about the new processes. The ultimate goal is to assure that manufacturing facilities are constructed to employ the processes and that forests of increased productivity are thereby regenerated.

Prior experience suggests that such process invention is most likely to occur if:

- the extent of the resource is fully understood
- full characterization data on lodgepole pine wood, bark, and foliage as industrial raw materials are readily available to process engineers and scientists
- the world literature on lodgepole pine is collected, keyworded, and made easily available
- a representative group of key lodgepole pine acreages for which responsible land managers seek intensified utilization are defined and thoroughly described in publications readily available to entrepreneurs as well as to process engineers.

The Forest Survey units of the Intermountain and the Pacific Northwest Research Stations, Forest Service, U.S. Department of Agriculture, have responsibility for developing timber resource data for the area of the United States in which lodgepole pine occurs. Relatively detailed resource information for lodgepole pine, including volume data by diameter class and geographic area, is available from the Intermountain Station for Idaho, Montana, Wyoming, Utah, and Colorado, and from the Pacific Northwest Station for Oregon and Washington.

Gross characteristics of lodgepole pine trees in North America, including a review of the world literature, are provided in General Technical Report INT-227 (Koch 1987) available from the Intermountain Research Station. Similar reports—with literature reviews—on detailed anatomical, chemical, permeability, and mechanical-property characteristics of lodgepole pine are being prepared by various university researchers under cooperative agreements with the Intermountain Research Station. Manuscripts for these reports are all scheduled for completion before the end of 1988.

For ready retrieval by researchers, the world literature on lodgepole pine has been collected, keyworded, filed, and essential data inserted in a computerized data base presently housed at Wood Science Laboratory, Inc., Corvallis, MT. The data base is accessible to the public through the Intermountain Research Station.

OBJECTIVE AND SCOPE

This General Technical Report provides general descriptions of a single representative problem area of more-or-less contiguous acreage within each of 28 public forests (National, Bureau of Land Management, and State) where increased utilization of lodgepole pine is desired by the forest manager (table 1-1 and fig. 1-2). Trees on each of these areas could be harvested and marketed over the next several decades according to management plans if

Table 1-1—Summary data on 28 selected acreages representing the unutilized lodgepole pine resource

State and Forest	Ranger District	Area name	Average elevation	Gross area	Age[1]	D.b.h.[2]	Access[3]	Terrain[4]
			Feet	*Acres*				
Colorado								
Gunnison	Taylor River	Taylor Lake	10,500	110,000	3	1+2+3	1	1+2
Rio Grande	Saguache	Sheep Creek	9,750	16,500	3	1+2	1	2
White River	Holy Cross	Tennessee Pass	9,500	28,000	3	1+2	1	2
State Forest	- - - - - - - - - southern end - - - - - - - - - -		9,500	16,000	3	1+2	1	2
BLM	Montrose	Rock Creek	10,200	8,900	3	1+2+3	2+3	2
Idaho								
Caribou	Soda Springs	Brockman Road	7,000	27,000	1+2	1+2	1	2
Challis	Yankee Fork	Cape Horn	6,800	3,400	2+3	1+2	1	1
Nez Perce	Elk City	Kirks Fork	5,000	5,040	2	1+2	2	2
Panhandle	Avery	Wampus, etc.	6,000	3,900	2	1+2	2	3
Payette	McCall	Stratton Creek	6,700	7,800	3	2+3	2	2
Salmon	Cobalt	Leesburg Basin	7,300	31,700	2+3	1+2+3	1	2
Montana								
Deerlodge	Deerlodge	Cottonwood Creek	6,500	3,000	2+3	1+2	1	2
Flathead	Tally Lake	Good Creek Burn	4,800	16,000	2	1+2	1	2
Gallatin	Bozeman	Goose-Levinski	7,800	7,000	2+3	1+2	2	3
Helena	Lincoln	Poorman Creek	6,400	25,000	2+3	1+2	1	2+3
Kootenai	Yaak	Zulu-Smoot	5,000	5,000	2	1	2	2
Oregon								
Fremont	Paisley	Witham	7,200	16,000	3	1+2+3	1+3	2
Malheur	Long Creek	Crawford Meadow	5,400	4,251	2	1+2	1	1
Mount Hood	Clackamas	Pinhead Butte	4,200	3,910	2+3	2+3	1	2
Utah								
Ashley	Vernal	Alma Taylor	9,000	16,000	2+3	1+2	1	1
Washington								
Colville	Colville and others	Pend Oreille River-Ruby Creek	4,000	40,000	2	1+2	1	2
Okanogan	Tonasket	Meadows Area	6,000	89,000	3	1+2	1	2
Wenatchee	Entiat	Big Creek-Lake Creek	5,000	2,000	3	1+2	2+3	3
State Forest	Northwest	Loomis Block	5,800	2,120	3	1+2	3	2
Wyoming								
Bighorn	Buffalo and Tongue	Piney Creek-Rock Creek	8,500	75,000	3	1+2	3	2
Bridger-Teton	Pinedale	South Wind River	8,800	41,000	3	2	2+3	2
Medicine Bow	Laramie	Upper Pelton Creek	9,000	7,880	3	1+2	1	2
Shoshone	Lander	Grannier Meadow-Dickinson Park	9,000	35,000	3	1+2	1	2

[1] 1 = <50; 2 = 50-80; 3 = 80+ years.
[2] 1 = sapling/pole <5.0 inches d.b.h.; 2 = pole/small sawtimber 5.0-8.9 inches d.b.h.; 3 = sawtimber 9.0+ inches d.b.h.
[3] 1 = accessed; 2 = perimeter access only; 3 = distance from roads.
[4] 1 = flat, <20 percent slope; 2 = mixed, with at least half <45 percent slope; 3 = predominantly steep, more than half 45 percent slope.

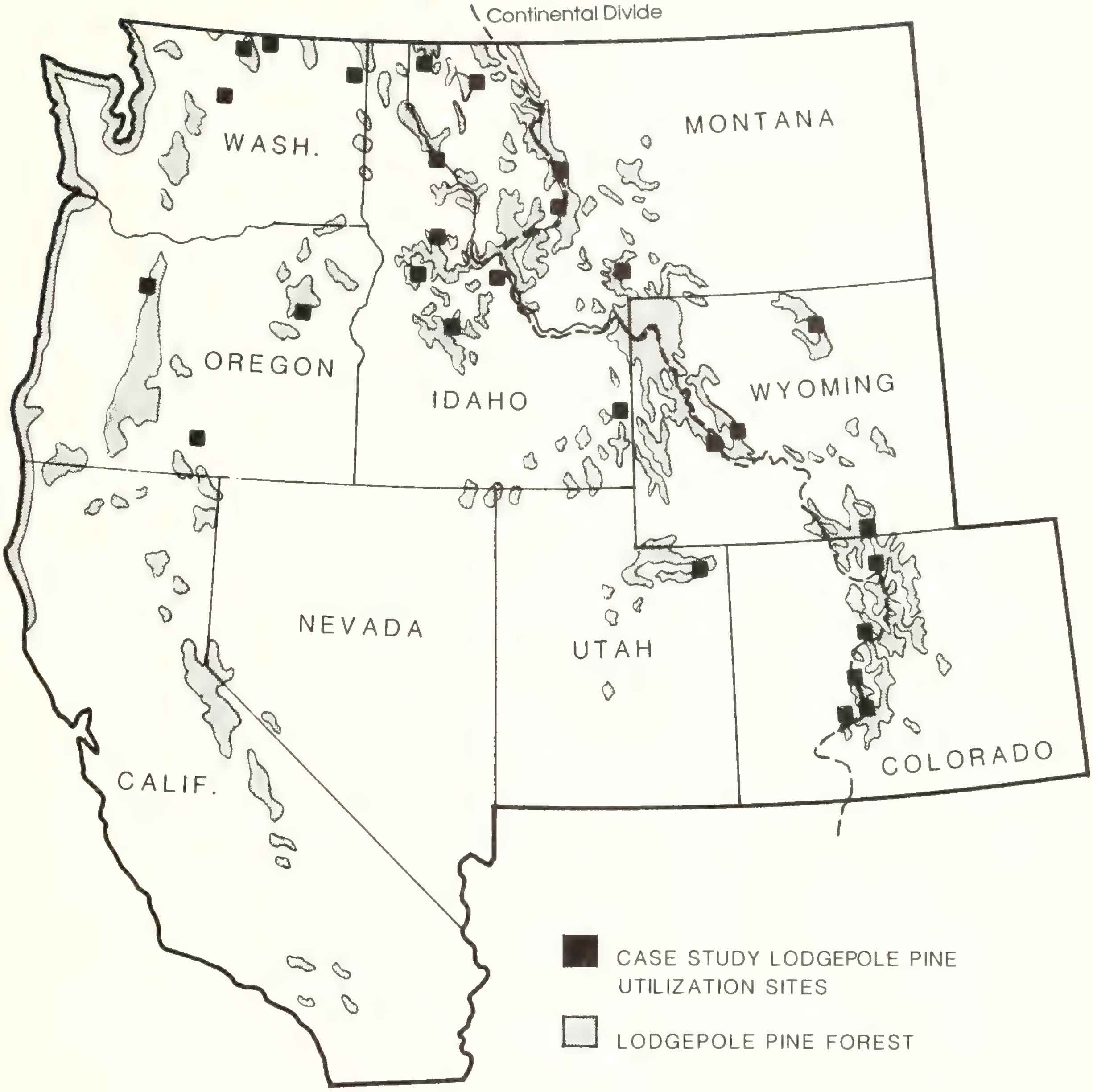

Figure 1-2—Representative problem areas—one within each of 28 forests (National, Bureau of Land Management, and State)—where the forest manager desires increased utilization of lodgepole pine.

commercially viable utilization operations could be devised incorporating harvesting procedures that meet land managers' objectives within an acceptable budget. Distances from railheads nearest each area to major markets in the United States are shown in table 1-2.

Each area contains at least 2,000 acres (in total, the 28 areas comprise 646,401 acres), and each could be termed a "hopeless case" where in 1986 the manager could not visualize near-term marketing of the stumpage—under acceptable conditions—for conventional processing. The selected acreages have been limited to one per forest, and therefore comprise only a small percentage of the total problem acreages they represent in the lodgepole pine forests of the United States.

As funds are available, more detailed timber inventory data will be developed for each of the 28 sample areas. To the extent possible, secondary data sources (stand exam records, etc.) are being used as a basis for improved characterization of the resource. Inventory information will be made generally available through Intermountain Research Station publications.

Common names of tree species are used in the area descriptions that follow; corresponding scientific names are listed in table 1-3.

Table 1-2—Highway distances from railhead towns adjacent to 28 selected areas to 16 cities representing major markets in the Midwest and East, West, and Southwest

State, Forest, and adjacent railhead	Midwestern and eastern cities					
	Boston	Chicago	Kansas City	Omaha	Rapid City	St. Paul
	Miles to major markets					
Colorado						
Gunnison (Salida)	2,072	1,154	681	675	532	1,010
Rio Grande (Salida)	2,072	1,154	681	675	532	1,010
White River (Leadville)	2,052	1,099	703	640	497	949
State Forest (Fort Collins)	1,942	989	665	530	330	828
BLM (Salida)	2,072	1,154	681	675	532	1,010
Idaho						
Caribou (Idaho Falls)	2,426	1,473	1,226	1,071	650	1,269
Challis (Boise)	2,639	1,683	1,382	1,227	906	1,445
Nez Perce (Grangeville)	2,673	1,710	1,580	1,335	831	1,315
Panhandle (St. Regis)	2,571	1,608	1,434	1,233	729	1,213
Payette (McCall vicinity)	2,747	1,791	1,490	1,335	921	1,405
Salmon (Darby)	2,565	1,602	1,428	1,227	723	1,207
Montana						
Deerlodge (Deer Lodge)	2,439	1,476	1,288	1,087	583	1,088
Flathead (Whitefish)	2,581	1,618	1,495	1,294	790	1,223
Gallatin (Bozeman)	2,317	1,354	1,166	965	461	966
Helena (Helena)	2,301	1,425	1,251	1,050	546	1,030
Kootenai (Libby)	2,690	1,727	1,553	1,352	848	1,332
Oregon						
Fremont (Lakeview)	2,970	2,007	1,673	1,610	1,232	1,739
Malheur (Baker)	2,773	1,810	1,509	1,354	1,033	1,542
Mount Hood (Portland)	3,046	2,083	1,809	1,654	1,204	1,688
Utah						
Ashley (Park City)	2,313	1,360	1,056	901	632	1,163
Washington						
Colville (Cusick)	2,716	1,753	1,579	1,378	874	1,358
Okanogan (Omak)	2,835	1,872	1,698	1,497	993	1,477
Wenatchee (Chelan)	2,872	1,909	1,735	1,534	1,030	1,514
State Forest (Omak)	2,835	1,872	1,698	1,497	993	1,477
Wyoming						
Bighorn (Sheridan)	2,099	1,136	931	735	243	782
Bridger-Teton (Rock Springs)	2,163	1,210	906	751	528	1,049
Medicine Bow (Laramie)	1,956	1,003	699	544	344	842
Shoshone (Riverton)	2,154	1,201	907	739	387	915

(con.)

Table 1-2 (Con.)

State, Forest, and adjacent railhead	Western cities				
	Denver	Portland	Salt Lake	San Francicso	Seattle
	Miles to major markets				
Colorado					
Gunnison (Salida)	138	1,247	480	1,172	1,316
Rio Grande (Salida)	138	1,247	480	1,172	1,316
White River (Leadville)	103	1,232	465	1,157	1,301
State Forest (Fort Collins)	65	1,194	471	1,223	1,263
BLM (Salida)	138	1,247	480	1,172	1,316
Idaho					
Caribou (Idaho Falls)	655	693	219	859	762
Challis (Boise)	811	432	340	658	501
Nez Perce (Grangeville)	1,009	412	538	856	383
Panhandle (St. Regis)	962	475	585	1,082	405
Payette (McCall vicinity)	919	502	448	766	473
Salmon (Darby)	896	611	460	1,023	541
Montana					
Deerlodge (Deer Lodge)	818	624	459	1,075	554
Flathead (Whitefish)	1,025	610	653	1,144	540
Gallatin (Bozeman)	696	746	337	953	676
Helena (Helena)	781	658	477	1,098	588
Kootenai (Libby)	1,081	509	704	1,201	439
Oregon					
Fremont (Lakeview)	1,073	337	569	415	509
Malheur (Baker)	938	311	467	785	488
Mount Hood (Portland)	1,238	0	767	636	172
Utah					
Ashley (Park City)	474	797	30	782	866
Washington					
Colville (Cusick)	1,107	366	730	900	325
Okanogan (Omak)	1,226	388	849	1,019	236
Wenatchee (Chelan)	1,263	333	850	1,086	181
State Forest (Omak)	1,226	388	849	1,019	236
Wyoming					
Bighorn (Sheridan)	424	1,015	535	1,287	945
Bridger-Teton (Rock Springs)	356	906	180	922	975
Medicine Bow (Laramie)	149	1,110	387	1,139	1,179
Shoshone (Riverton)	395	1,028	321	1,063	1,097

(con.)

Table 1-2 (Con.)

State, Forest, and adjacent railhead	Southwestern cities				
	Dallas	Las Vegas	Los Angeles	Phoenix	Reno
	Miles to major markets				
Colorado					
Gunnison (Salida)	779	714	996	719	948
Rio Grande (Salida)	779	714	996	719	948
White River (Leadville)	839	699	981	763	933
State Forest (Fort Collins)	846	842	1,124	857	994
BLM (Salida)	779	714	996	719	948
Idaho					
Caribou (Idaho Falls)	1,430	650	932	867	630
Challis (Boise)	1,582	666	849	951	429
Nez Perce (Grangeville)	1,780	864	1,047	1,149	627
Panhandle (St. Regis)	1,737	994	1,259	1,233	853
Payette (McCall vicinity)	1,690	774	957	1,059	537
Salmon (Darby)	1,671	971	1,136	1,108	794
Montana					
Deerlodge (Deer Lodge)	1,591	890	1,172	1,107	846
Flathead (Whitefish)	1,798	1,059	1,324	1,298	918
Gallatin (Bozeman)	1,469	768	1,050	985	724
Helena (Helena)	1,554	908	1,190	1,125	869
Kootenai (Libby)	1,856	1,113	1,378	1,352	972
Oregon					
Fremont (Lakeview)	1,540	684	697	969	237
Malheur (Baker)	1,709	793	976	1,078	556
Mount Hood (Portland)	2,009	981	959	1,266	538
Utah					
Ashley (Park City)	1,272	463	745	678	553
Washington					
Colville (Cusick)	1,182	1,068	1,223	1,299	796
Okanogan (Omak)	2,001	1,187	1,342	1,472	915
Wenatchee (Chelan)	2,038	1,169	1,326	1,509	857
State Forest (Omak)	2,001	1,187	1,342	1,472	915
Wyoming					
Bighorn (Sheridan)	1,197	954	1,236	1,121	1,058
Bridger-Teton (Rock Springs)	1,125	613	895	828	703
Medicine Bow (Laramie)	918	806	1,088	843	910
Shoshone (Riverton)	1,116	754	1,036	969	844

Table 1-3—Common and scientific names of three varieties of lodgepole pine and some tree species frequently found in association with lodgepole pine

Common name	Scientific name
Bigtooth aspen	*Populus grandidenta* Michx.
Douglas-fir	*Pseudotsuga menziesii* (Mirb.) Franco
Engelmann spruce	*Picea engelmannii* Parry ex Engelm.
Grand fir	*Abies grandis* (Dougl. ex D. Don) Lindl.
Lodgepole pine	
Lodgepole pine	*Pinus contorta* var. *latifolia* Engelm.
Shore pine	*Pinus contorta* Dougl. ex Loud. var. *contorta*
Sierra lodgepole pine	*Pinus contorta* var. *murrayana* (Grev. & Balf.) Engelm.
Mountain hemlock	*Tsuga mertensiana* (Bong.) Carr
Ponderosa pine	*Pinus ponderosa* Dougl. ex Laws. var. *ponderosa*
Subalpine fir	*Abies lasiocarpa* (Hook.) Nutt.
Western hemlock	*Tsuga heterophylla* (Raf.) Sarg.
Western larch	*Larix occidentalis* Nutt.
Western redcedar	*Thuja plicata* Donn ex D. Don
Western white pine	*Pinus monticola* Dougl. ex D. Don
White fir	*Abies concolor* (Gord. & Glend.) Lindl. ex Hildebr.

TRANSPORT NETWORKS

The 28 areas are largely concentrated adjacent to the Continental Divide and at higher elevations between the Cascade Mountains and the Continental Divide (fig. 1-2). Most major markets are far to the east and south (fig. 1-3). Long-distance transport costs are therefore critical to profitable large-scale utilization of lodgepole pine for most purposes. Rail transport networks (fig. 1-4) are needed for long hauls to the Midwest, East, and South. Truck transport via the Interstate Highway System (fig. 1-5) may be economical for the closest midwestern, southwestern, and western markets (table 1-2). Transport by river network (fig. 1-6) is probably impractical with the possible exception of access to Pacific Rim markets from the head of navigation (Lewiston, ID) on the Snake River.

Additional comments on transport networks will be made in the general descriptions of the 28 areas, organized alphabetically by State, in table 1-1.

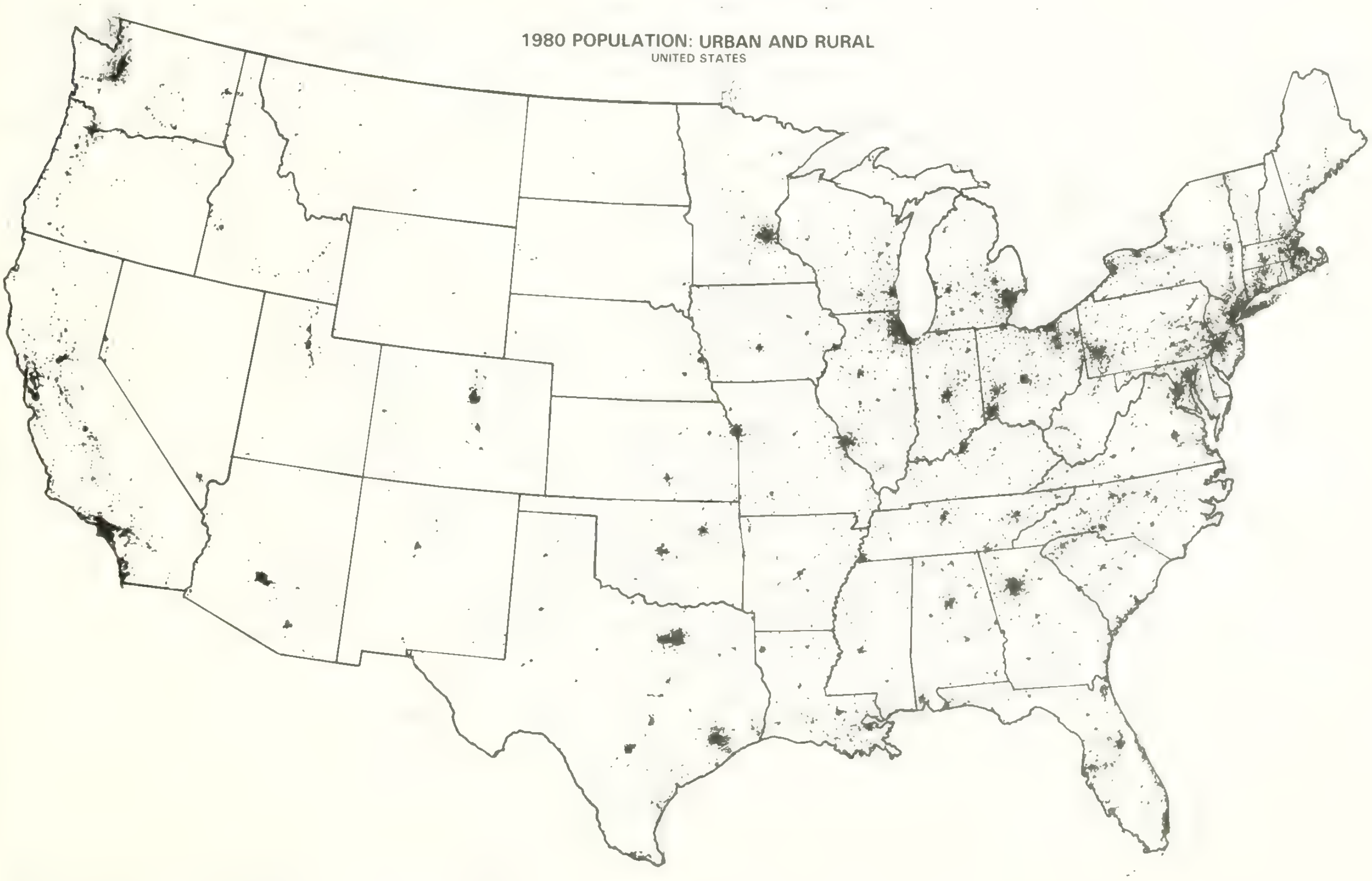

Figure 1-3—Population distribution in the United States.

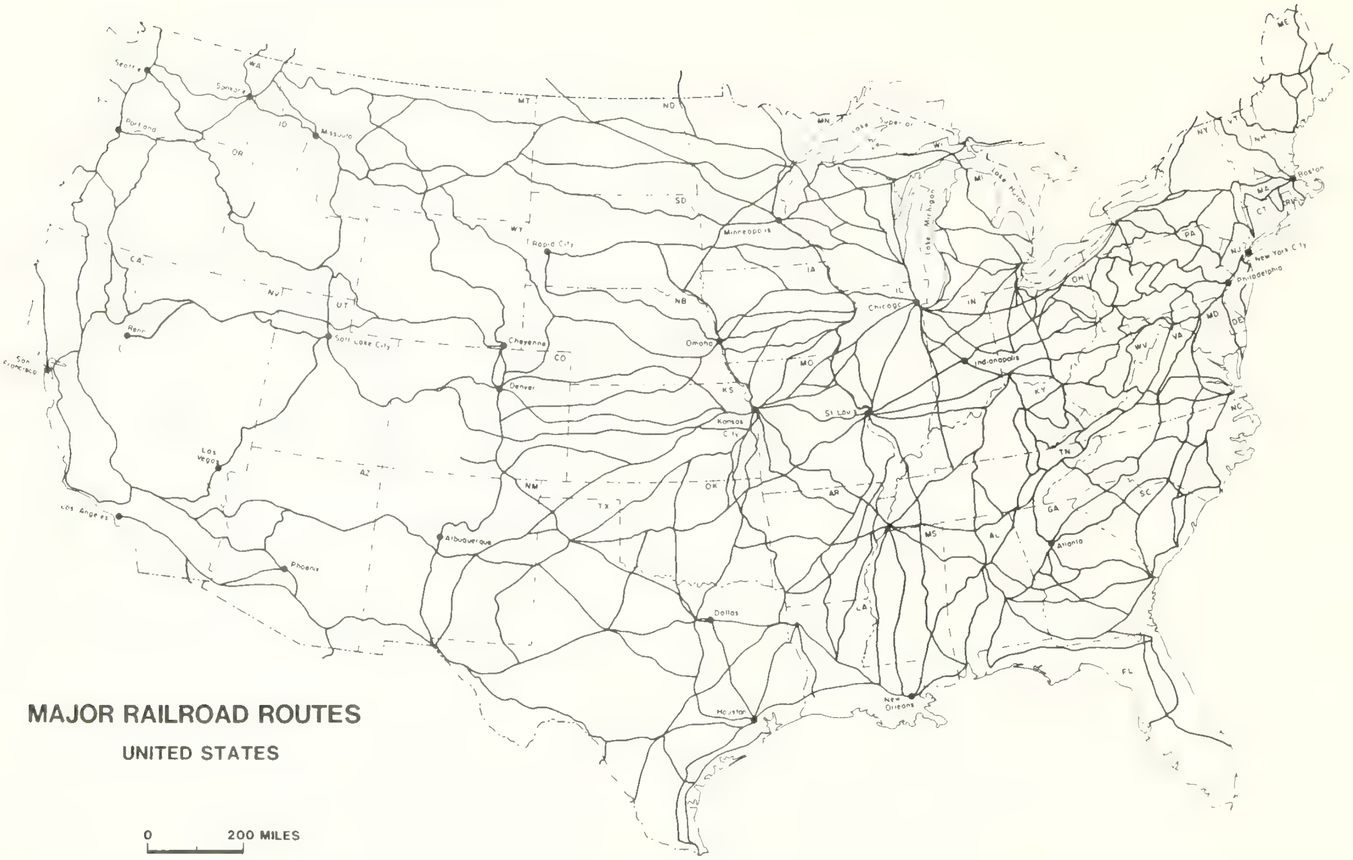

Figure 1-4—Major railroad routes serving the continental United States.

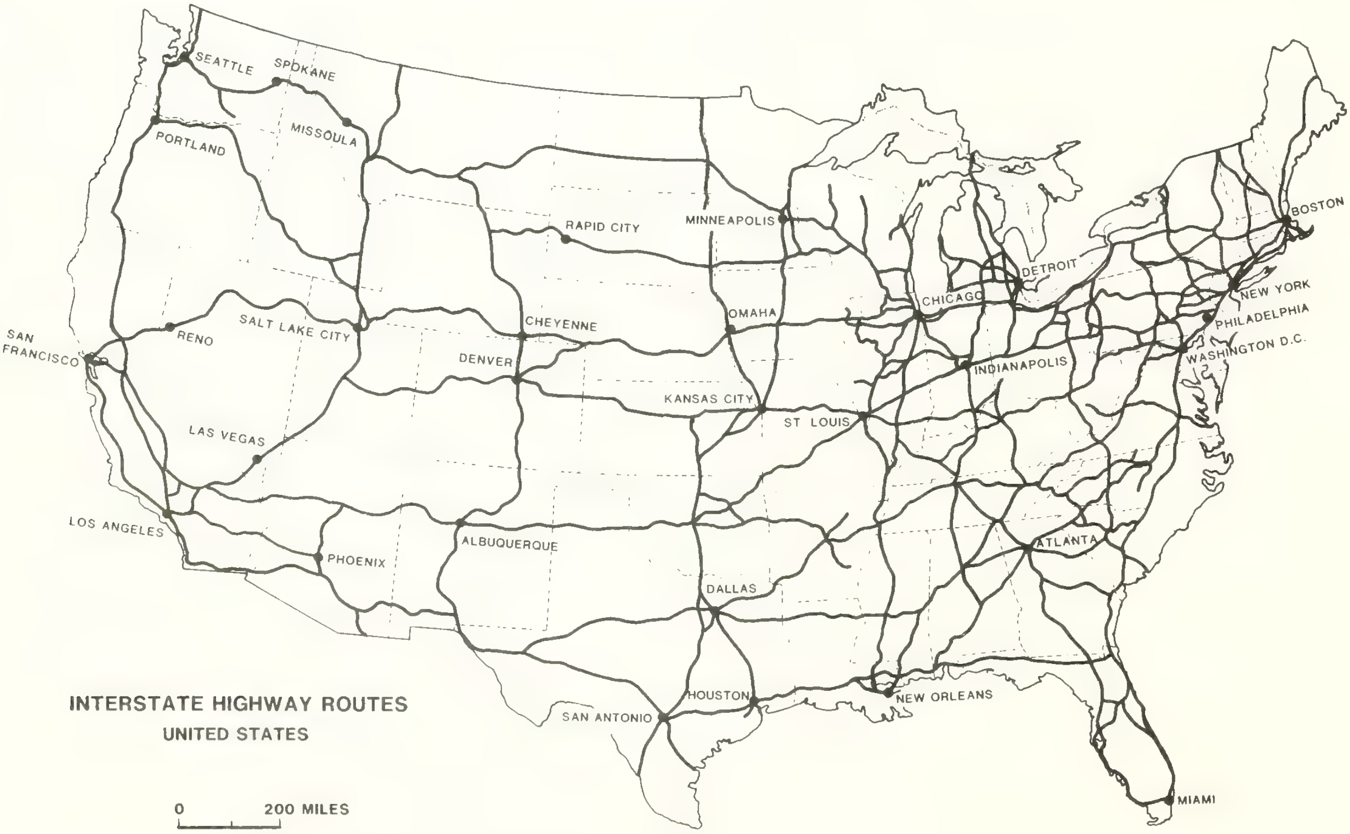

Figure 1-5—The Interstate Highway System of the continental United States.

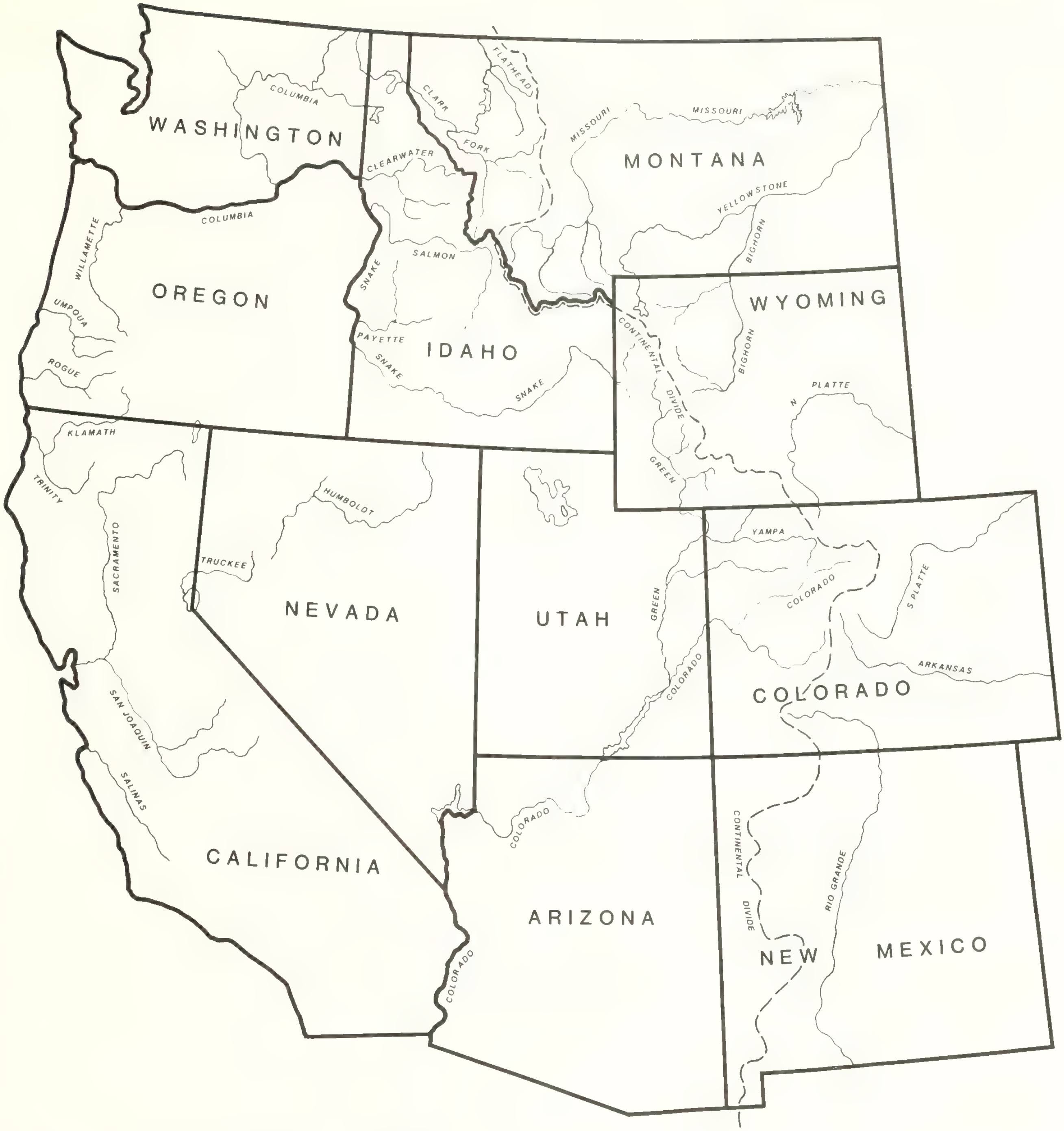

Figure 1-6—Major rivers of the Western United States.

REFERENCES

Koch, Peter. 1987. Gross characteristics of lodgepole pine in North America. Gen. Tech. Rep. INT-227. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 311 p.

Little, Elbert L., Jr. 1971. Atlas of United States trees. Vol. 1: Conifers and important hardwoods. Misc. Publ. 1146. Washington, DC: U.S. Department of Agriculture, Forest Service. 7 p. text, 98 maps.

CHAPTER 2: COLORADO

INTRODUCTION

In Colorado, lodgepole pine predominates on about 1.7 million acres of the State's 12.2 million acres of commercial forest land, with about 3.1 billion ft^3 of lodgepole pine growing stock and 9.1 billion bd ft of sawtimber (table 2-1). Approximately 24 percent of the softwood growing stock and 18 percent of the softwood sawtimber in the State is lodgepole pine (Benson and Green 1987).

Approximately 53 percent of the dry weight of aboveground biomass of lodgepole pine trees in Colorado is in trees smaller than the 10-inch d.b.h. class (table 2-2).

The five areas selected for study by managers of public forest lands in Colorado (fig. 2-1) total 179,400 acres in gross area; they are described in the following text.

GUNNISON NATIONAL FOREST

Area Name and Location—The Taylor Lake area (figs. 2-2 and 2-3), which lies at an elevation of 10,000 to 11,500 feet at latitude 38°45' and longitude 106°30', is in the Taylor River Ranger District of the Gunnison National Forest; the Ranger Station is in Gunnison.

The gross area of about 110,000 acres includes about 75,000 acres of lodgepole pine timber type and falls entirely within Gunnison County; Gunnison is the county seat. The area is centered around Taylor Park Reservoir immediately southwest of the crest of the Sawatch Mountains (the Continental Divide), and is about 20 air miles due east from Crested Butte.

Maps of the Area—United States Geological Survey (USGS) quadrangle 7½' maps needed to depict the area are : Italian Creek, Pieplant, Taylor Park Reservoir, Fairview Peak, Tincup, Cumberland Pass, and Winfield.

Access—All-weather roads accessed from Gunnison traverse the centers of all quarters of the area. Highway mileage from Gunnison to Taylor Park Reservoir is 32 miles; this paved road is plowed during winter. Roads beyond the reservoir are not winter plowed, however. From the reservoir it is 14 miles east to Cottonwood Pass (12,126 feet) and another 22 miles to Buena Vista; this Cottonwood Pass road is scheduled to be paved. Highway distance from Cottonwood Pass to Colorado Springs is about 108 miles.

The nearest railhead is Buena Vista, on the Denver and Rio Grande Western line from Leadville through Salida to Pueblo. Salida is 25 miles south of Buena Vista. For highway distances from Salida to various market centers in the United States, see table 1-2.

Table 2-1—Volume of lodgepole pine growing stock and sawtimber, and acreage in lodgepole pine, by ownership class, Colorado[1]

Ownership class	Growing stock[2]	Sawtimber volume[3]	Commercial timberland area
	Million ft^3	*Million bd ft International ¼-inch scale*	*Thousand acres*
National Forest (commercial)[4]	2,228.0	7,123.0	1,270.0
Other public	320.3	747.8	182.0
Forest industry	0	0	0
Other private	535.7	1,252.2	273.0
Total	3,084.0	9,123.0	[4]1,725.0

[1] Source: Benson and Green (1987).

[2] **Growing stock volume** = net volume in cubic feet of live sawtimber and pole timber trees (5 inches d.b.h. and larger) from stump to a minimum 4-inch top outside bark, or to the point where the central stem breaks into limbs.

[3] **Sawtimber volume** = net volume in board feet of the sawlog portion of live sawtimber trees. Sawtimber trees are live trees of commercial species, 9 inches in d.b.h. or larger (softwood), containing at least one 12-foot sawlog or two noncontiguous 8-foot sawlogs, and meeting regional specifications for freedom from defect.

[4] **Commercial timberland** = forest land that is capable of producing crops of industrial wood and not withdrawn from timber utilization by statute or administrative regulation. Areas qualifying as commercial timberland have the capability of producing in excess of 20 ft^3/acre of industrial wood in natural stands.

Table 2-2—Dry weight of lodgepole pine trees, by tree component and diameter class—Colorado[1]

Diameter class	Bole[2]	Top[2]	Total
Inches	*- - - Thousand tons, ovendry basis - - -*		
2	—	1,684	1,684
4	—	4,549	4,549
6	10,274	3,854	14,128
8	8,753	2,449	11,202
10	7,571	1,940	9,511
12	6,131	1,690	7,821
14	4,232	1,064	5,296
16	2,099	502	2,601
18	1,139	255	1,394
20+	780	180	960
Total	40,979	18,167	59,146

[1] Source: Van Hooser and Chojnacky (1983).

[2] **Trees 5+ inches d.b.h.**: Bole weight = ovendry weight of wood and bark from a 1-foot stump to a 4-inch top diameter, inside bark; top weight = ovendry weight of wood and bark from a 4-inch diameter to tip of tree, plus branch material down to ¼-inch diameter.

Trees less than 5 inches d.b.h.: Total ovendry weight of wood and bark from a 1-foot stump to tip of tree, plus branch material down to ¼-inch diameter (tabulated under "Top").

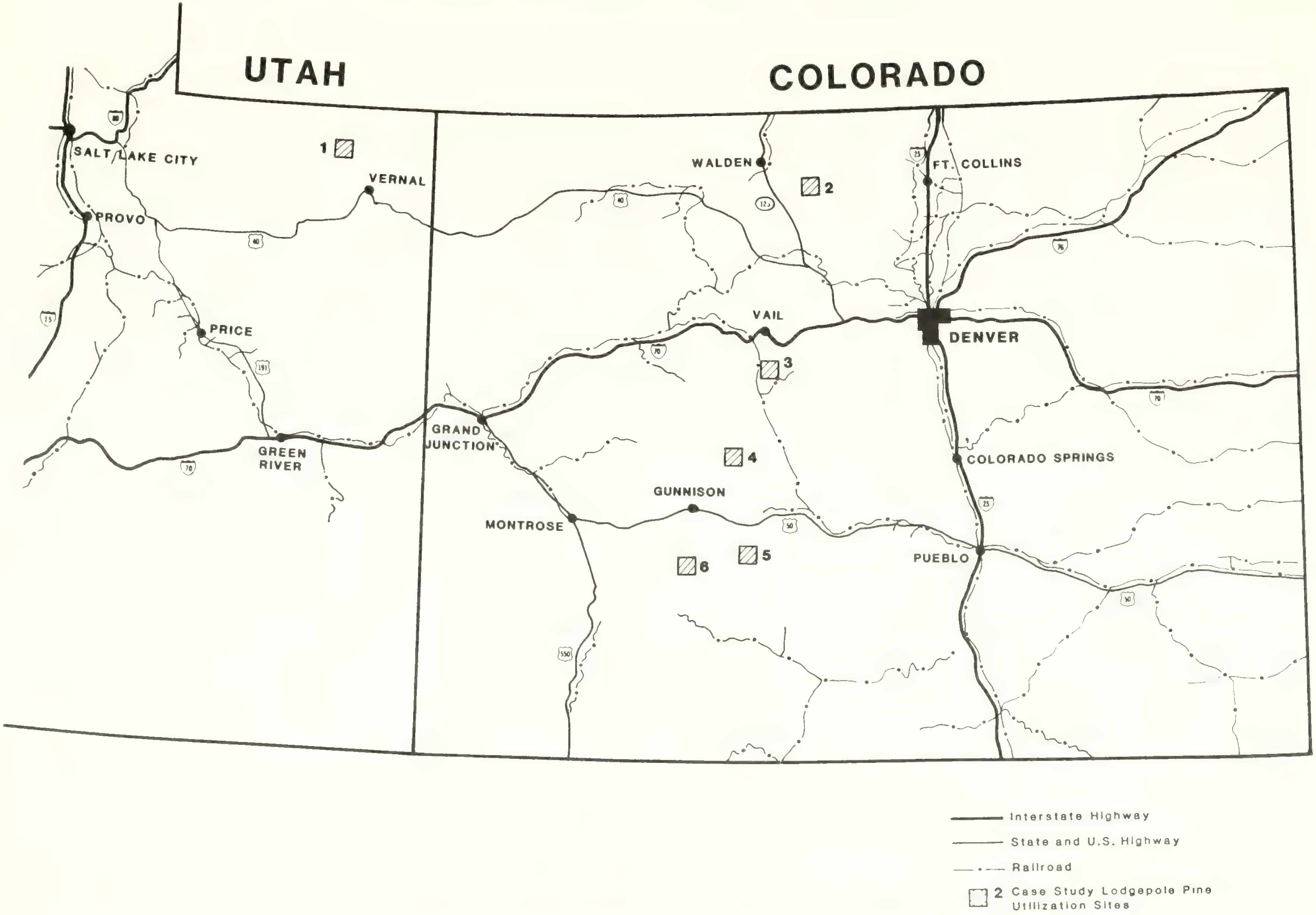

Figure 2-1—Colorado and Utah location map. 1. Ashley NF (Alma Taylor) 16,000 acres. 2. State Forest (south end) 16,000 acres. 3 White River NF (Tennessee Pass) 28,000 acres. 4. Gunnison NF (Taylor Lake) 110,000 acres. 5. Rio Grande NF (Sheep Creek) 16,500 acres. 6. BLM Forest (Rock Creek) 8,900 acres.

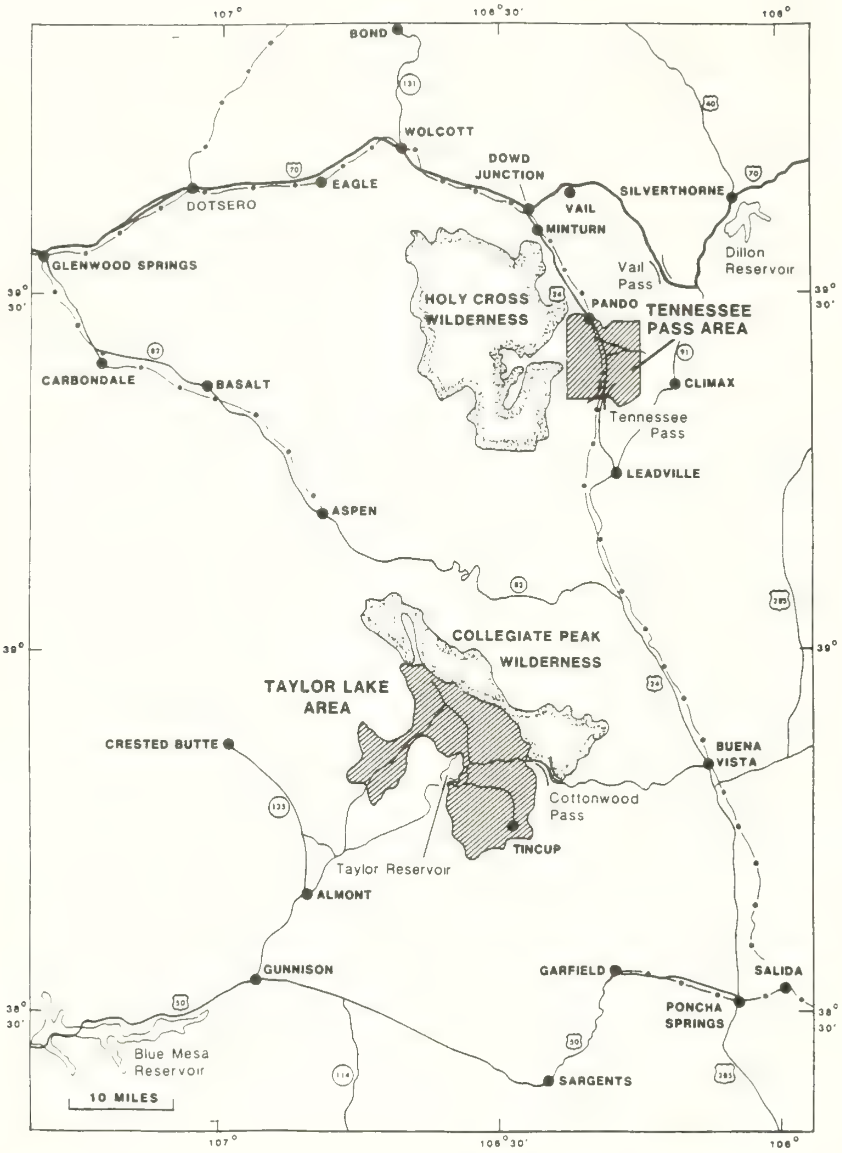

Figure 2-2—Vicinity map for the Taylor Lake (Gunnison National Forest) and Tennessee Pass (White River National Forest) areas of Colorado.

Terrain and Soil—As previously noted, the timbered area lies mostly between 10,000 and 11,500 feet elevation, with nearly three-fourths of the acreage having slopes of less than 45 percent. Soils are sandy. There are no special terrain obstacles to harvesting. Large bodies of timber are interspersed with grasslands (fig. 2-4).

Annual Precipitation and Duration of Snow-free Season—Annual precipitation totals 20 to 25 inches, with 3 feet of snow common in late winter. Snow-free season is generally from about June 1 to October 31.

General Character of the Timber—About two-thirds of the lodgepole timber acreage carries old-growth trees (200+ years); the remainder is in pole stands averaging 90 to 110 years old (figs. 2-5 and 2-6). The old-growth timber (7 to 17 inches d.b.h.) is decadent, with limby wolf trees common. Ground cover and duff are minimal. Considerable spiral grain is evident on larger down timber, particularly at higher elevations.

At present, mortality caused by mountain pine bark beetles is not evident, and there is little evidence of damage from rusts or porcupines. Dwarf mistletoe, however, is prevalent in some stands.

Harvests were extensive between 1890 and 1900. Since that time, harvest activities have been minor. Currently, however, harvesting is scheduled on a 2,000-acre sale.

Data on Sample Trees—A pair of adjacent 3½- to 4-inch trees from the tall understory of an old-growth stand (at 10,300 feet elevation and close to the Trail Creek road about 11 miles north-northwest of the reservoir) were destructively sampled. Some pertinent tree characteristics follow. These tabulated data should not be interpreted as statistically representative of all trees.

See appendix for an explanation of tree selection and procedures for evaluation of mechanical properties in compression parallel to the grain at 10 percent moisture content.

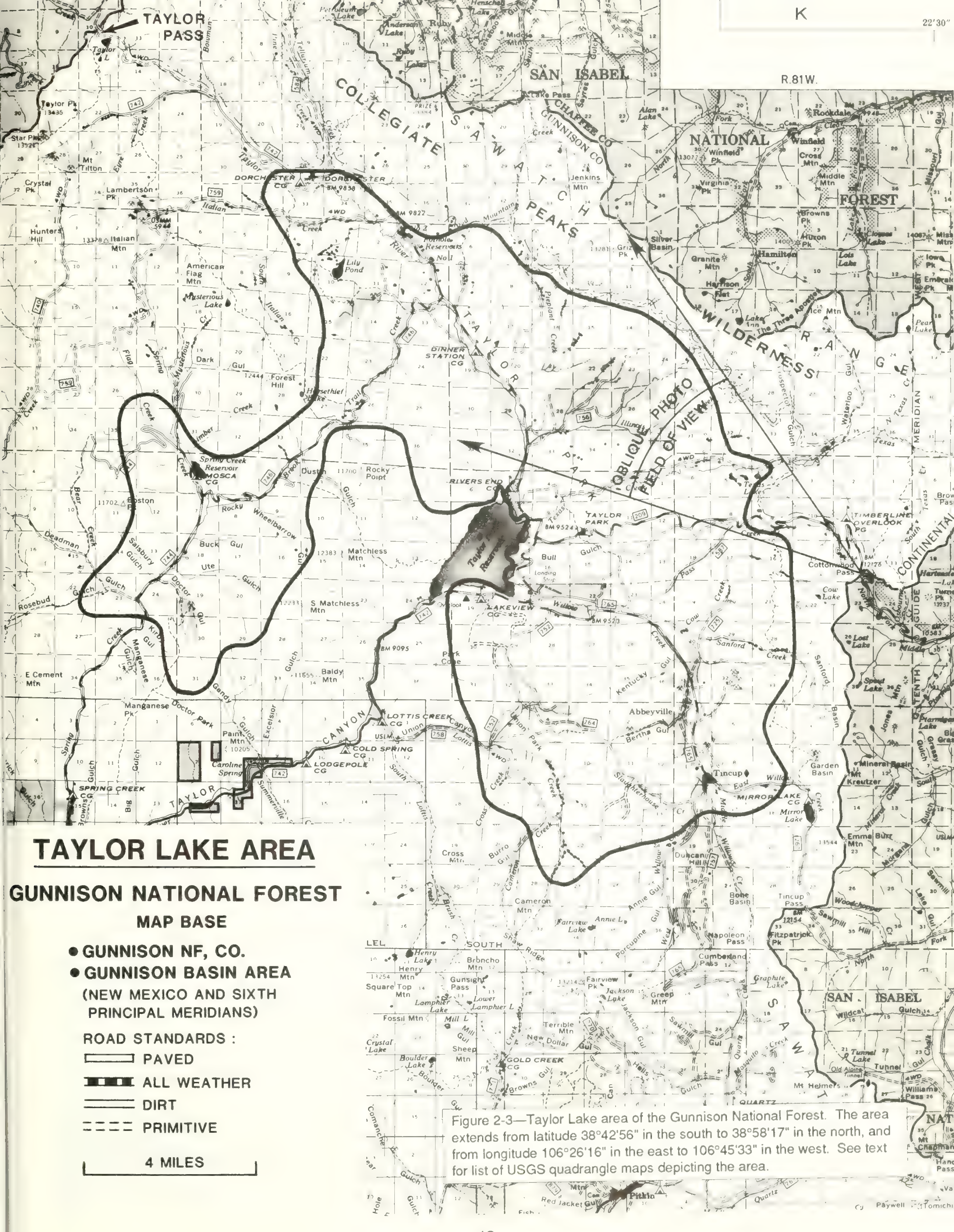

Figure 2-3—Taylor Lake area of the Gunnison National Forest. The area extends from latitude 38°42'56" in the south to 38°58'17" in the north, and from longitude 106°26'16" in the east to 106°45'33" in the west. See text for list of USGS quadrangle maps depicting the area.

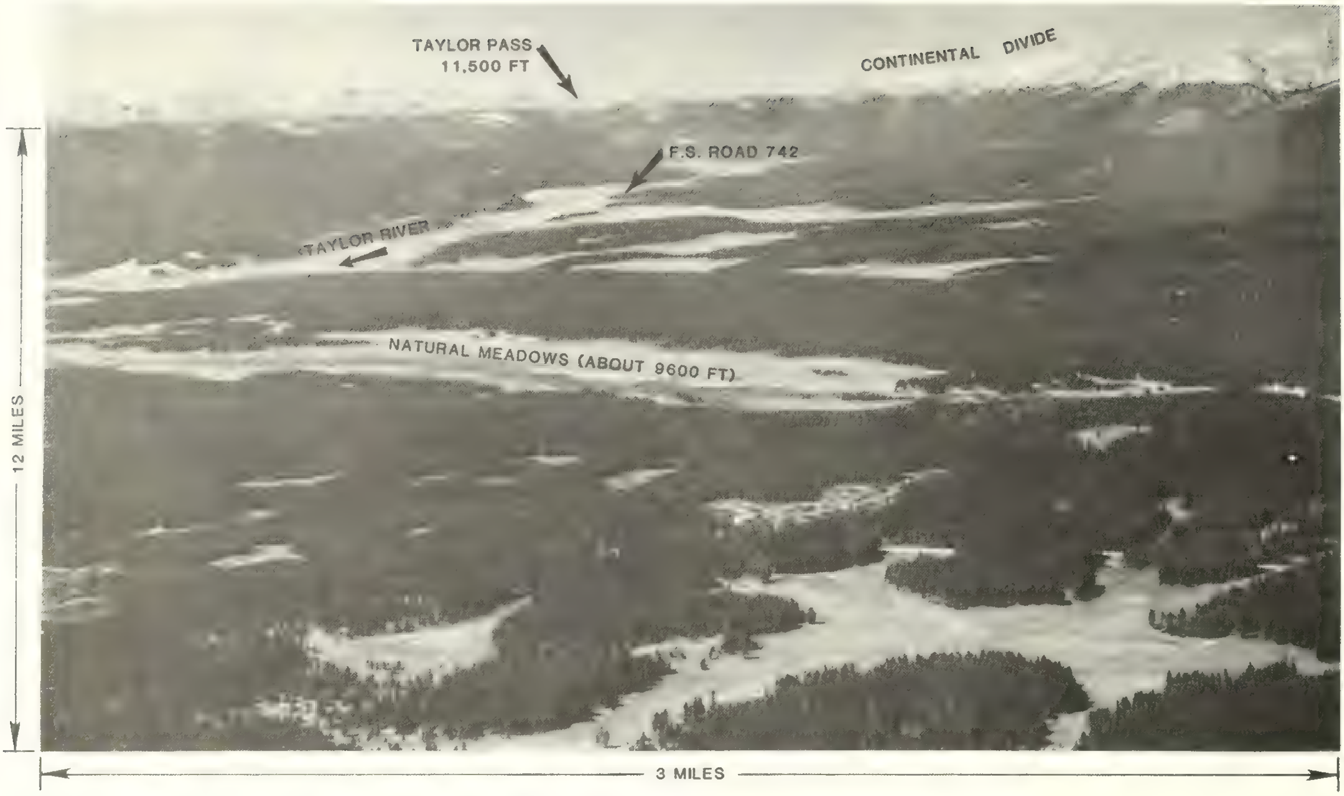

Figure 2-4—Oblique view of Taylor Lake area looking northwest from the Cottonwood Pass road; see figure 2-3 for camera viewpoint and field. Width of foreground shown is about 3 miles; from foreground to timberline on the peaks in the background is about 12 miles.

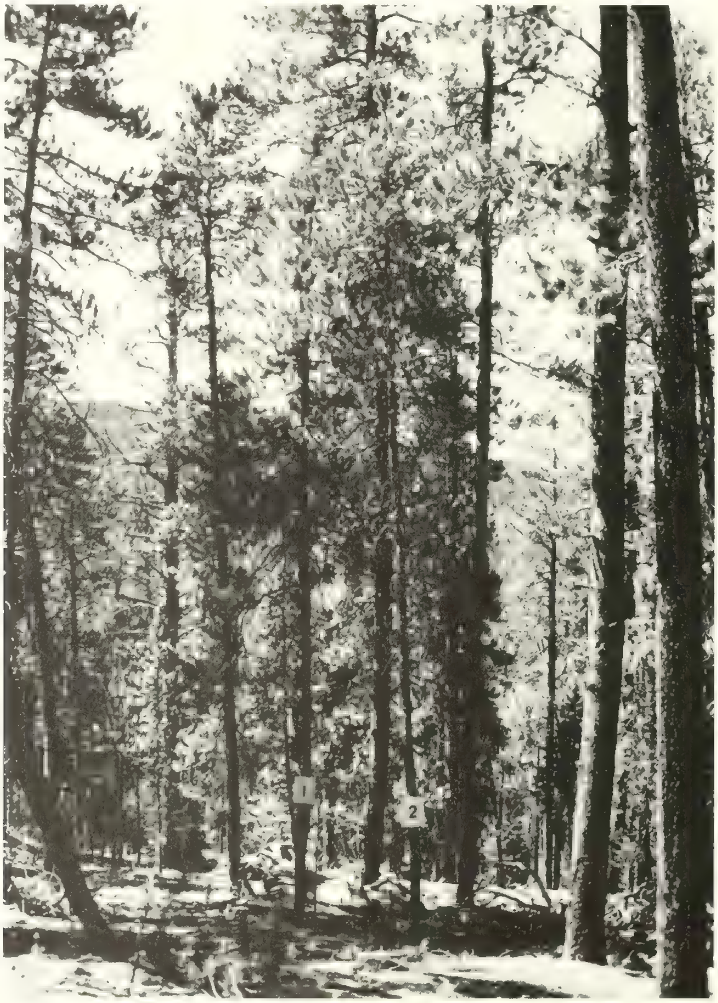

Figure 2-5—Pair of sample trees 3½ to 4 inches in d.b.h. in tall understory of old-growth stand in the Taylor Lake area of the Gunnison National Forest. See text for typical stand table.

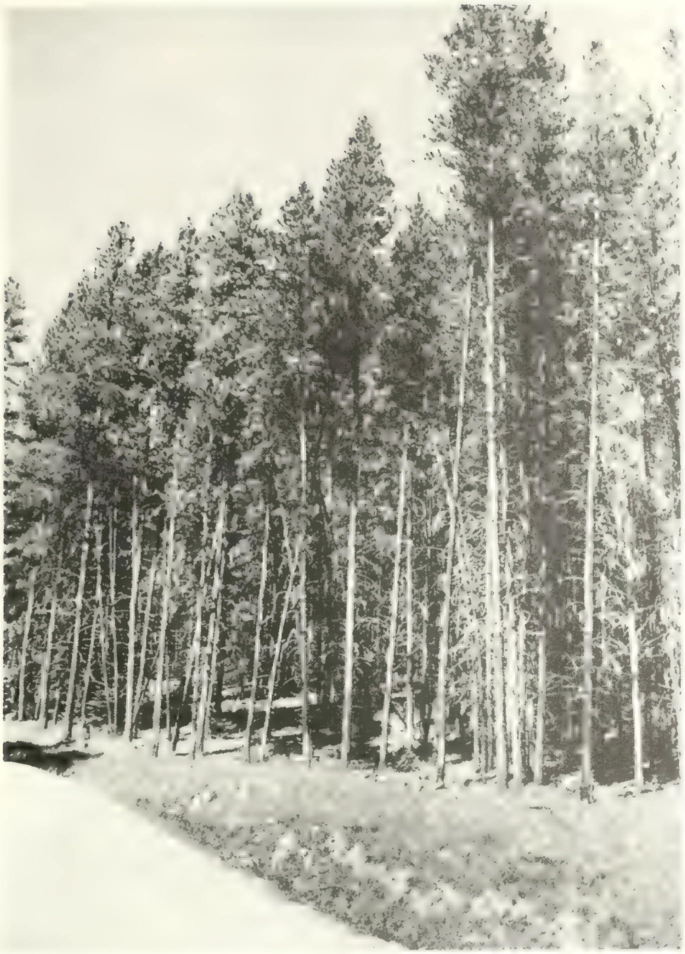

Figure 2-6—Pole stand in the Taylor Lake Area of the Gunnison National Forest. See text for typical stand table.

Characteristic	Tree number 1	Tree number 2
D.b.h. (outside bark), inches	4.05	3.57
Tree height above 6-inch high stump, feet	26.25	25.00
Crown ratio, percent	60.6	32.7
Cone serotiny	open	open
Tree age years (number of annual growth rings)		
Stump height	220	240
20 percent of tree height	200	200
Base of live crown	144	100
Diameter inside bark, inches		
Stump height	4.03	3.52
20 percent of tree height	3.54	3.18
Base of live crown	3.22	2.26
Height from stump top to base of crown, inches	123	202
Stem taper inside bark, inches/100 inches		
Below crown	0.66	0.62
Within crown	1.70	2.31
Rings/inch, average for section		
Stump height	109	136
Base of live crown	89	89
Properties of stemwood at 20 percent height		
Moisture content, percent ovendry weight	96.8	79.7
Specific gravity, ovendry weight and green volume	0.401	0.440
Rings/inch in first $1\frac{1}{4}$ inches radius	112	134
Maximum crushing strength, lb f/in^2	5,770	6,410
Proportional limit	4,270	5,110
Modulus of elasticity, lb f/in^2	950,000	1,330,000
Compression wood evident?	slight	slight
Spiral grain angle at surface, degrees	5	5
Bark thickness (single), inch	0.20	0.16
Pith eccentricity, inch	0.1	0.1

Inventory Data—Inventory data on the area are incomplete. As noted previously, about two-thirds of the lodgepole pine acreage carries old-growth timber, while one-third is in pole stands. Managers responsible for the area estimate typical stand data for these two timber age classes as follows:

D.b.h. class	Old-growth type	Pole timber type
Inches	*- - Number of live stems per acre - -*	
<2.9	48	300
3.0-3.9	100	100
4.0-4.9	120	100
5.0-5.9	159	234
6.0-6.9	159	285
7.0+	205	46
Total	791	1,065

Cubic Yield Potential and Height Growth—Although not well documented, it is estimated that the current lodgepole pine forests in the area are growing about 40 ft^3 per acre per year; the potential is estimated at 60 ft^3 per acre per year. Fifty-year height growth in a managed stand is undetermined, but on an above-average site in the present stands it is about 54 feet.

Management Objectives for the Area and Constraints—The primary timber management objective is harvest of the decadent older stands and replacement with thrifty, controlled-density natural regeneration. The area is much used for recreation, and it is important for its wildlife habitat and watershed functions; these values, however, are not seen as major deterrents to improved management for timber production. The major deterrent is lack of markets for stumpage. In 1985 and 1986 the forest received about $6 per thousand board feet (M bd ft) Scribner scale for lodgepole sawtimber stumpage and $5 per cord for firewood (dead trees) cut from the area. Revenues from the sawtimber stumpage were generally less than the full cost of preparing the sawtimber sales.

Other Lodgepole Pine Available in the Area From Public Lands—In addition to the 75,000 acres of lodgepole pine in the Taylor Lake area, the Cebolla Ranger District of the Gunnison National Forest—immediately south of the Taylor River Ranger District—has an additional 140,000 acres of lodgepole pine timber type. About 70,000 of these acres are similar to those in the Taylor Lake area.

Forest Products Industry in the Vicinity—There are no large forest industries immediately adjacent to the area. Major timber consumers in the region include a large sawmill cutting random-length dimension lumber and a structural flakeboard plant—both near Montrose, CO. Also, a house log manufacturer operates in Poncha Springs.

Population in the Vicinity—Gunnison County has a total population of 11,286 (1983), almost all of whom reside within 30 miles of Gunnison—the home of Western State College. Population within the limits of the town of Gunnison totals 5,902. In 1983 the per-capita income in Gunnison County was $7,874, with 5.9 percent of the workforce unemployed.

Chaffee County, with a population of 13,500, contains the nearest railhead at Buena Vista (population 2,500). The county seat of Chaffee County is Salida (population 5,000). In 1984, 12.1 percent of the county workforce was unemployed.

RIO GRANDE NATIONAL FOREST

Area Name and Location—The Sheep Creek area (figs. 2-7 and 2-8), which lies at an elevation of 9,000 to 11,500 feet at latitude 38°15' and longitude 106°30', is in the Saguache Ranger District of the Rio Grande National Forest; the Ranger Station is in Saguache.

The gross area of about 16,500 acres includes about 9,100 acres of lodgepole pine timber type and falls entirely within Saguache County; Saguache is the county seat. The area is centered around the upper end of Sheep Creek and lies immediately south of the Continental Divide; it is about 23 air miles northwest from Saguache on a heading of 303°.

Maps of the Area—USGS quadrangle 7½' maps needed to depict the area are: West Baldy, Sargents Mesa, North Pass, and Trickle Mountain.

Access—From a point 25.5 miles west of Saguache on paved State Highway No. 114, an unimproved dirt road

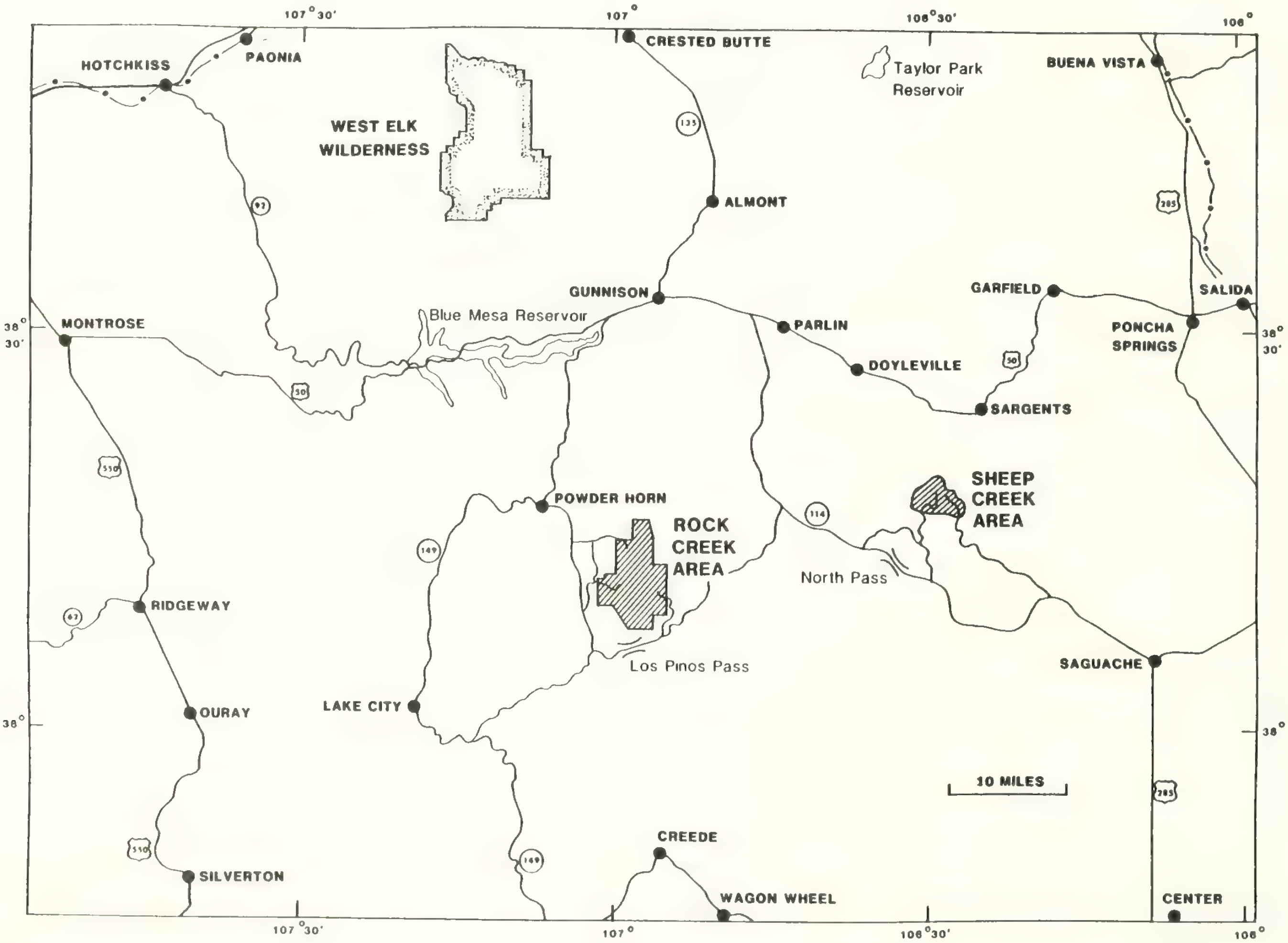

Figure 2-7—Vicinity map for the Sheep Creek (Rio Grande National Forest) and Rock Creek (Bureau of Land Management) areas of Colorado.

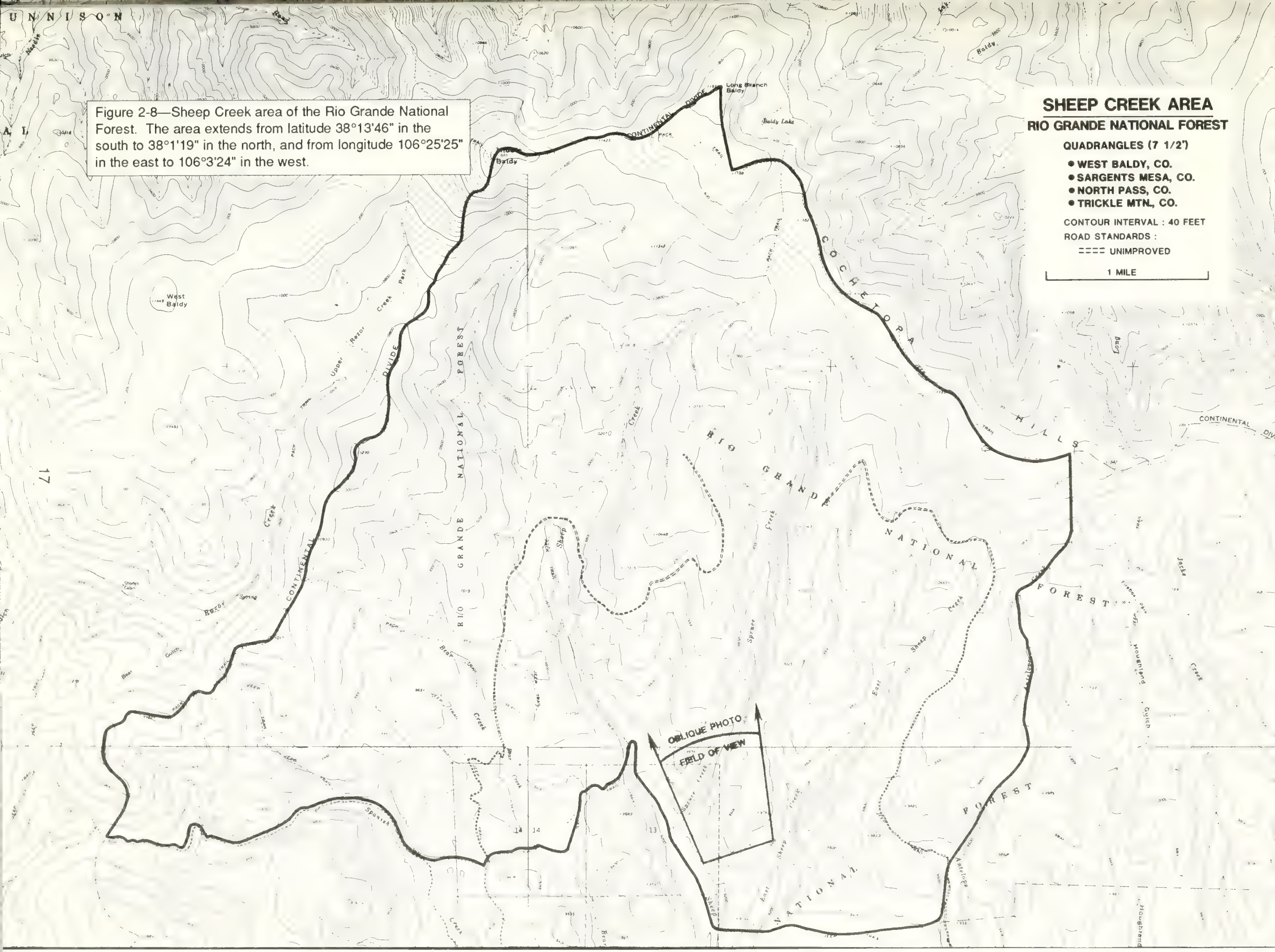

Figure 2-8—Sheep Creek area of the Rio Grande National Forest. The area extends from latitude 38°13'46" in the south to 38°1'19" in the north, and from longitude 106°25'25" in the east to 106°3'24" in the west.

(FDR No. 810) leads north 10.3 miles through the center of the western portion of the area to a road end in the center of the area. Another unimproved dirt road (FDR No. 850) leading from State Highway No. 114 gives access to the eastern part of the area.

The nearest railhead is Salida on the Denver and Rio Grande Western line from Leadville to Pueblo. For highway distances from Salida to various market centers in the United States, see table 1-2.

Terrain and Soil—As previously noted, the area lies between 9,000 and 11,500 feet elevation (figs. 2-9 and 2-10), with about three-quarters of the acreage having slopes less than 45 percent. Soils are of volcanic origin and are highly erosive. There are no special obstacles to harvesting.

Annual Precipitation and Duration of Snow-free Season—Annual precipitation totals about 20 inches, with 2 feet of snow commonly on the ground during winter. The snow-free season generally extends from mid-May to early November.

General Character of the Timber—The lodgepole timber in the area can be classified into three types. The predominant type (about 37 percent of the acreage) typically has 1,000 to 2,000 stems per acre of suppressed trees about 25 feet in height and measuring 1½ to 6 inches in d.b.h., with most trees 3 to 4 inches in d.b.h. and 90 to 120 years old. Crown ratios are typically 30 percent (fig. 2-11).

Pole stands with 400 to 600 trees per acre, 4 to 7 inches in d.b.h., 30 to 32 feet high, occupy about 35 percent of the area. These trees are also 90 to 120 years old. Older stands (200+ years) have only about 100 trees per acre, but measure 7 to 12 inches in d.b.h., and are 40 to 50 feet high, with crown ratio of about 40 percent.

In most stands, approximately half the trees bear open cones, and half bear closed cones. Thirty to 60 percent of seeds from the cones are viable.

At present (1986), no damage from mountain pine beetle is evident, but western gall rust has caused cankers in a significant proportion of the trees. There is little to no damage from dwarf mistletoe, and porcupine damage is not evident.

There has been virtually no harvesting activity in the area in the past. In the older stands, some minor harvests are planned.

Data on Sample Trees—To provide more than casual observational data descriptive of the trees, a pair of adjacent 3½- to 4-inch codominant trees were destructively sampled. The trees were located on fairly level terrain at 10,200 feet elevation (fig. 2-11) about one-quarter mile south of the road end in the central part of the area. Some pertinent tree characteristics follow. These tabulated data should not be interpreted as statistically representative of all trees.

See appendix for an explanation of tree selection and procedures for evaluating of mechanical properties parallel to the grain at 10 percent moisture content.

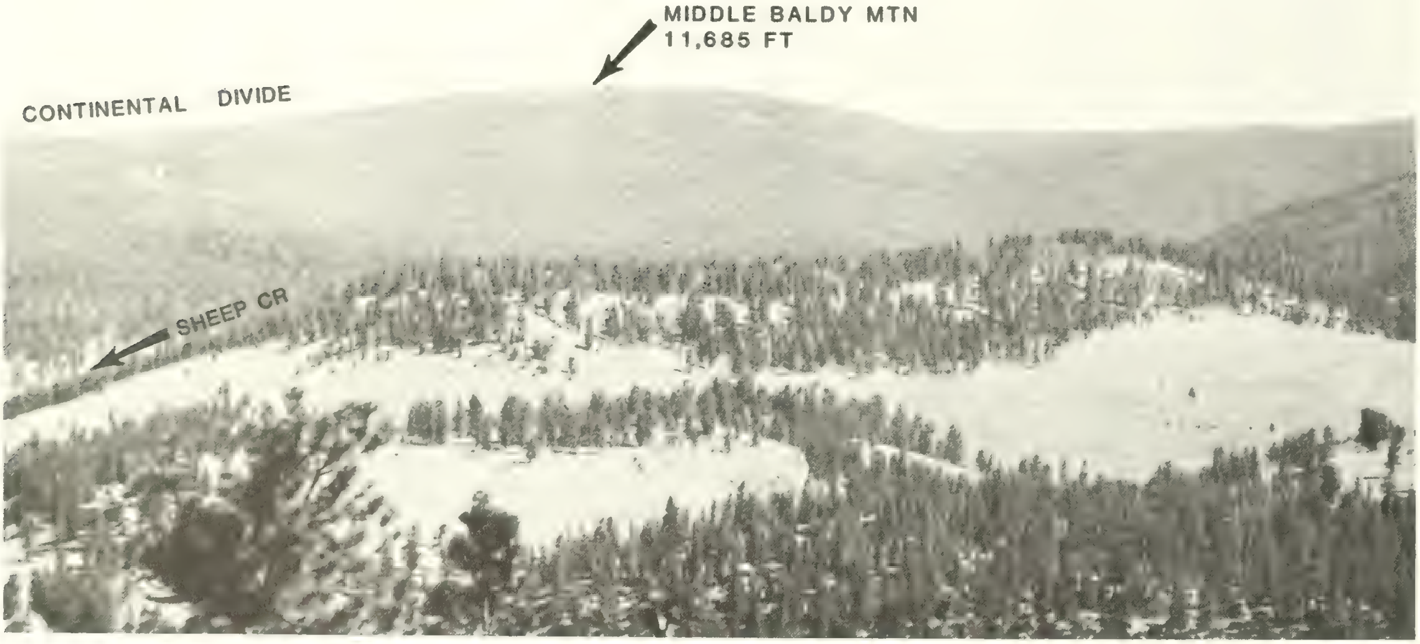

Figure 2-9—Oblique view of the Sheep Creek area looking north-northwest from a promontory on lower Sheep Creek; see figure 2-8 for field of view. From the foreground to the Continental Divide, which forms the skyline, it is about 5½ miles. Length of ridge shown on the skyline is about 2½ miles.

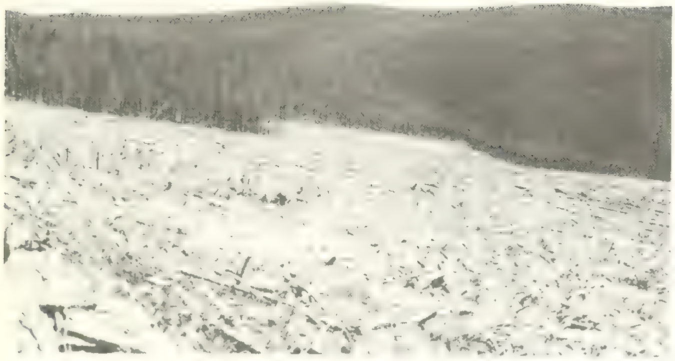

Figure 2-10—View looking east across Spruce Creek in the central part of the Sheep Creek area of the Rio Grande National Forest. In an effort to replace a stagnated stand, the area in foreground was trampled and roller chopped without previous harvest or subsequent burn; regeneration, while not evident in the photo, is present. In the background, trees are 200+ years old—except for the old-burn area visible in the right background, which now supports a younger pole stand.

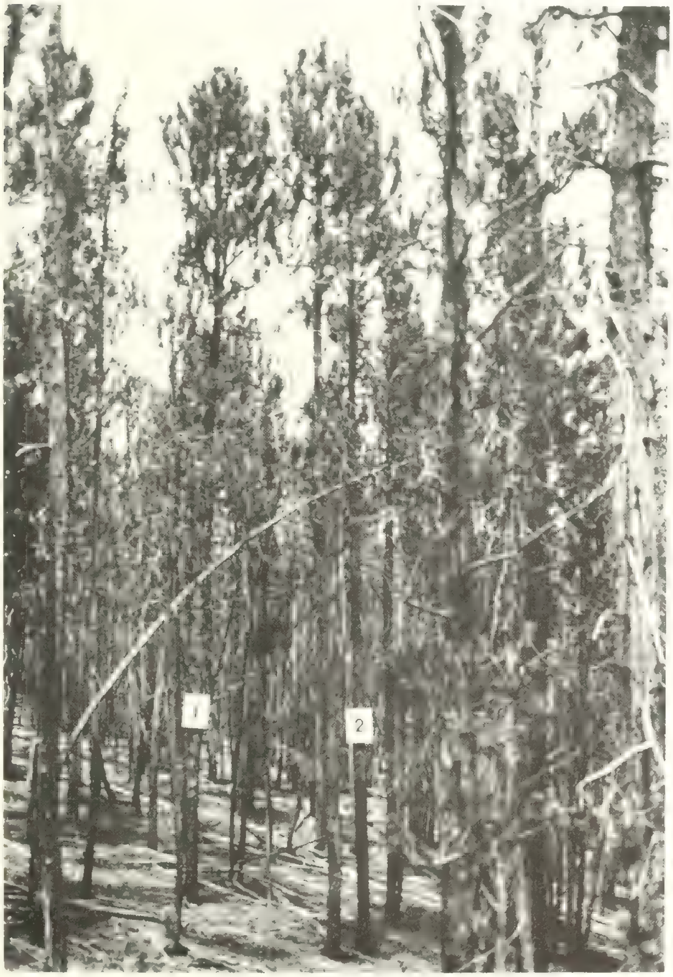

Figure 2-11—Pair of codominant sample trees $3\frac{1}{2}$ to 4 inches in d.b.h. in a stagnated stand at about 10,200 feet elevation in the Sheep Creek area of the Rio Grande National Forest.

Characteristic	Tree number 1	Tree number 2
D.b.h. (outside bark), inches	3.90	3.5
Tree height above 6-inch high stump, feet	21.8	22.0
Crown ratio, percent	35.6	37.1
Cone serotiny	closed	closed
Tree age years (number of annual growth rings)		
Stump height	130	130
20 percent of tree height	110	105
Base of live crown	71	60
Diameter inside bark, inches		
Stump height	3.82	3.61
20 percent of tree height	3.65	3.33
Base of live crown	2.75	2.37
Height from stump top to base of live crown, inches	168	166
Stem taper inside bark, inches/100 inches		
Below crown	0.64	0.75
Within crown	2.96	2.42
Rings/inch, average for section		
Stump height	68	72
Base of live crown	52	51
Properties of stemwood at 20 percent height		
Moisture content, percent ovendry weight	75.5	65.0
Specific gravity, ovendry weight and green volume	0.438	0.384
Rings/inch in first $1\frac{1}{4}$ inches radius	48	36
Ultimate compresssive strength, lb f/in^2	5,790	5,250
Proportional limit, lb f/in^2	3,610	4,140
Modulus of elasticity, lb f/in^2	970,000	870,000
Compression wood evident?	none	none
Spiral grain angle at surface, degrees	7	3
Bark thickness (single), inch	0.15	0.16
Pith eccentricity, inch	0.6	0.4

Inventory Data—Inventory data are incomplete. See prior comments under paragraph heading "General Character of the Timber" for stand-table generalizations about the three types of lodgepole pine timber present.

Cubic Yield Potential and Height Growth—Although data are not well documented, managers responsible for the area estimate that the current stands are growing more than 10 ft^3 per acre per year. Under management they might grow 25 ft^3 per acre per year. Fifty-year height growth in managed stands is estimated at 30 to 35 feet.

Management Objectives for the Area and Constraints—The primary timber management objective is phased harvest of the stagnant and decadent stands and replacement with thrifty, controlled-density natural regeneration. The area has significant value for watershed, wildlife habitat, and recreation—values that could be enhanced and protected by appropriate management for timber production.

The major deterrent is lack of markets for stumpage. In 1985 and 1986 the forest received $2 to $20 (mostly $2) per M bd ft Scribner scale for lodgepole pine sawtimber stumpage, $5 per cord for dead-timber firewood, and $12.50 per cord for live-timber firewood and miscellaneous roundwood from the area. Revenues from sawtimber stumpage for the area were generally less than the full cost of preparing the sawtimber sales.

Other Lodgepole Pine Available in the Area—In addition to the lodgepole pine on the Sheep Creek area, the Saguache Ranger District has approximately 20,000 acres of the same kind of lodgepole timber. And, as noted in discussions of the Taylor Lake area, the Cebolla Ranger District of the Gunnison National Forest to the north and west has perhaps 75,000 acres of similar lodgepole pine.

Forest Products Industry in the Vicinity—There are three very small sawmills in Saguache. Monte Vista has a medium-size sawmill; Alamosa has a moderately large mill—but it was not in operation at 1986 yearend; and South Fork has a large stud mill and a medium-size sawmill for random-length dimension lumber. A small industry producing mine props and house logs operates in Creede.

Population in the Vicinity—Saguache County has a total population of 3,946 (1985); population within the limits of the town of Saguache totals 625. In 1980 the per-capita income in Saguache County was $4,504, with 16 percent of the workforce unemployed in 1985.

Chaffee County, with a population of 13,500, contains the nearest railhead at Salida (population 5,000). In 1984, 12.1 percent of the county workforce was unemployed.

WHITE RIVER NATIONAL FOREST

Area Name and Location—The Tennessee Pass area (figs. 2-2, 2-12, and 2-13), which lies at an elevation of 10,000 to 11,000 feet at latitude 39°26' and longitude 106°25', is in the Holy Cross Ranger District of the White River National Forest; the Ranger Station is in Minturn.

The gross area of about 28,000 acres includes about 11,000 acres of lodgepole pine timber type and falls entirely within Eagle County; Eagle is the county seat. The Lake County northern line (the Continental Divide) is the southern border of the area; the county seat of Lake County is Leadville. The area is centered around Eagle Park and the Camp Hale recreation area.

Maps of the Area—USGS quadrangle 7$^1/_2$' maps needed to depict the area are: Pando and Leadville North.

Access—U.S. Highway No. 24 connects with Interstate 70 near Vail and runs south through the center of the area, over Tennessee Pass (10,424 feet) to Leadville and Buena Vista. A Denver and Rio Grande Western rail line parallels this road (fig. 2-2). The Wurts Ditch Road (unimproved dirt) traverses the western portion of the area, and several improved and unimproved roads penetrate the eastern portion (fig. 2-12). From Minturn south to Tennessee Pass is 20 miles; Leadville is about 10 miles south of Tennessee Pass.

For highway distances from Leadville to various market centers in the United States, see table 1-2.

Terrain and Soil—As previously noted, the timbered area lies mostly between 10,000 and 11,000 feet elevation, with nearly half the lodgepole pine acreage on slopes of less than 45 percent (fig. 2-14). Soils are decomposed granite, with no volcanic ash deposition. The terrain is not excessively stony. Ground cover is light and duff is thin.

Annual Precipitation and Duration of Snow-free Season—Annual precipitation is about 30 inches, most falling as snow, with heavy snow accumulation in winter months. The snow-free season generally extends from June 1 to the end of October.

General Character of the Timber—At upper elevations, stands tend to be somewhat open and trees limby (fig. 2-15), with all-age stands common. On the main benches at midelevation, pole stands are more typical of the species (fig. 2-16). Stands vary in age from about 85 to 135 years.

At present, mortality caused by mountain pine beetle is not evident. Most stands have light infestations of dwarf mistletoe, but not all. Cankers caused by rust infections are not common, and significant porcupine damage is not evident.

The area was extensively harvested and/or burned in 1890-1900. Except for small-scale firewood and post-and-pole cutting, harvesting activity is minimal at present. No major harvesting activity has been planned because the area is distant from mills.

Data on Sample Trees—A pair of adjacent 3$^1/_2$- to 4-inch codominant trees were destructively sampled from a south slope about three-fourths mile east of Camp Hale site (fig. 2-16). Some pertinent tree characteristics follow. These tabulated data should not be interpreted as statistically representative of all trees.

See appendix for an explanation of tree selection and procedures for evaluation of mechanical properties in compression parallel to the grain at 10 percent moisture content.

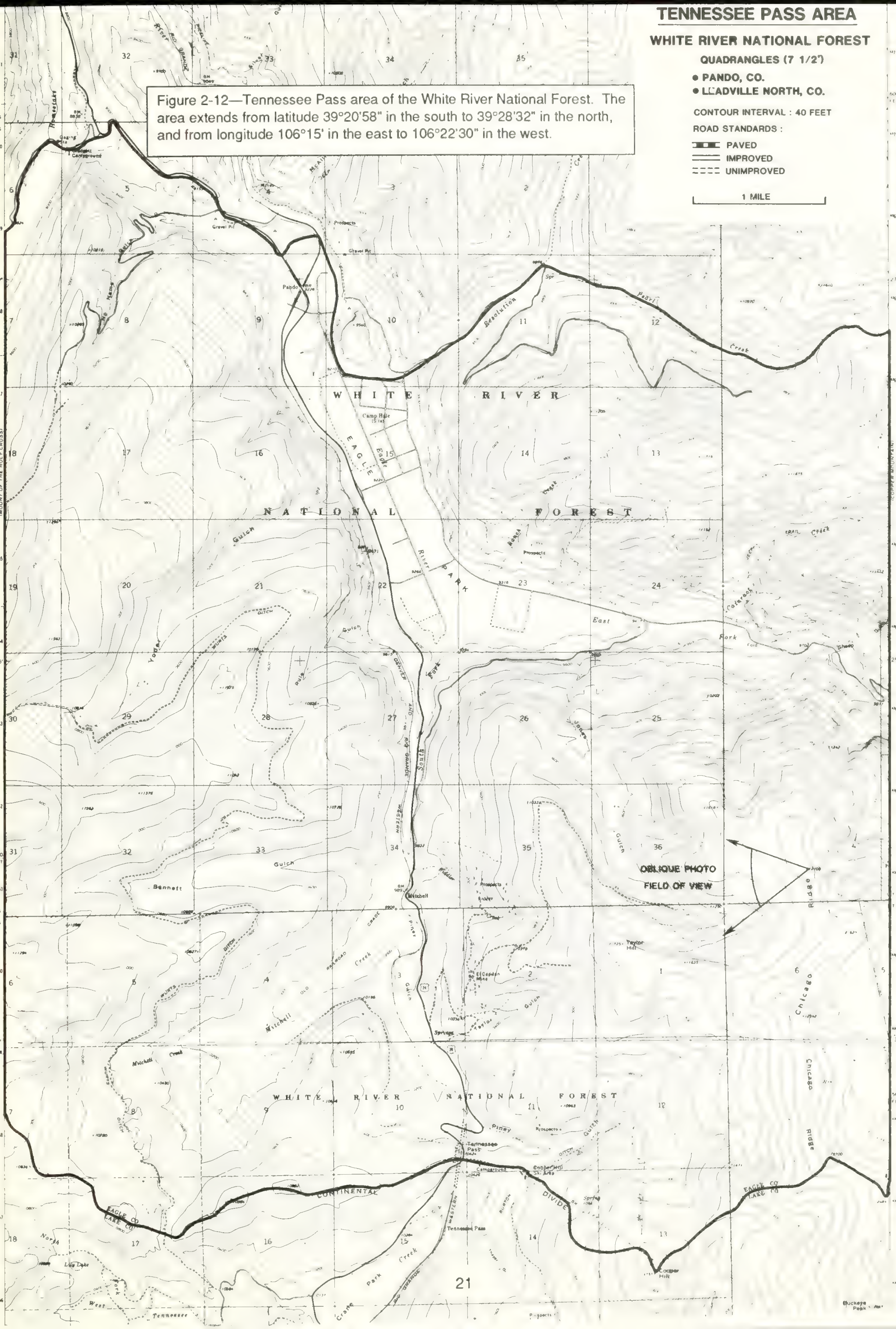

Figure 2-12—Tennessee Pass area of the White River National Forest. The area extends from latitude 39°20'58" in the south to 39°28'32" in the north, and from longitude 106°15' in the east to 106°22'30" in the west.

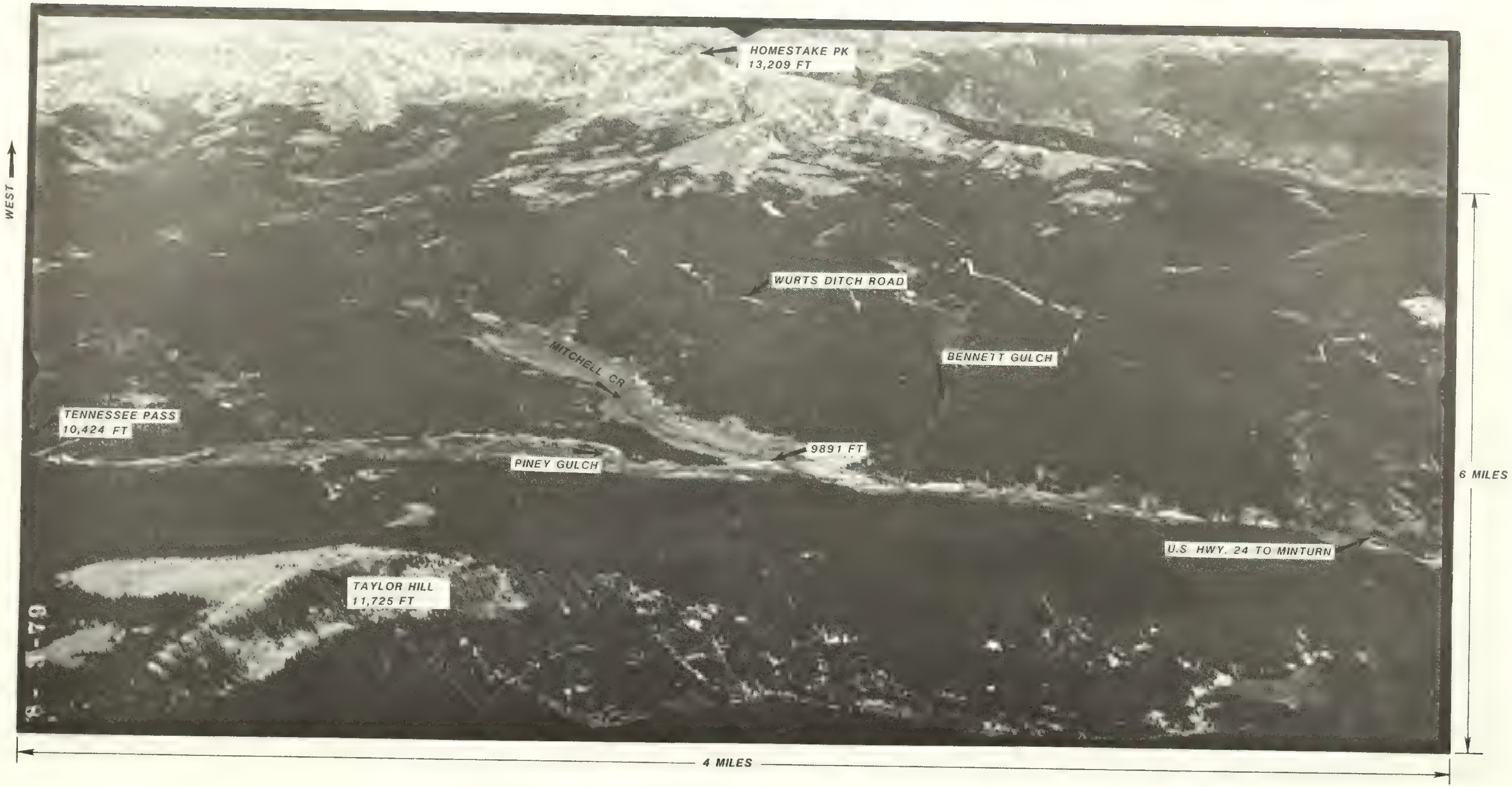

Figure 2-13—Oblique aerial view of the Tennessee Pass area of the White River National Forest looking east (see fig. 2-12 for camera viewpoint and field of view). Width of foreground shown is about 4 miles; from foreground to treeline in the center background is about 6 miles.

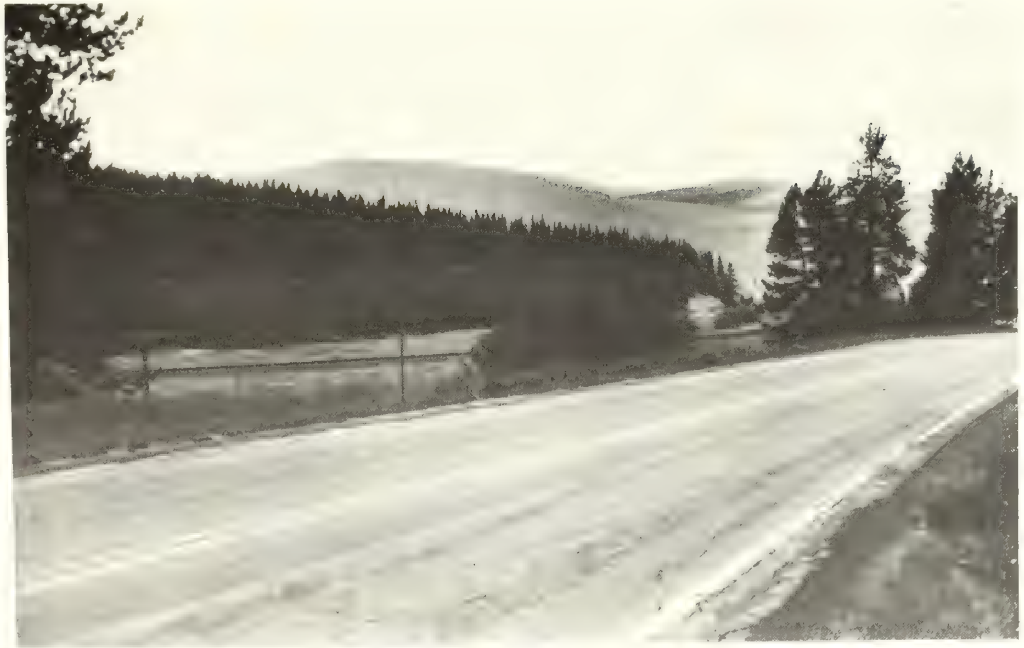

Figure 2-14—View northwest across U.S. Highway No. 24 and the Denver and Rio Grande Western rail line paralleling it from Minturn to Leadville and Buena Vista. Terrain below Wurts Ditch visible in background.

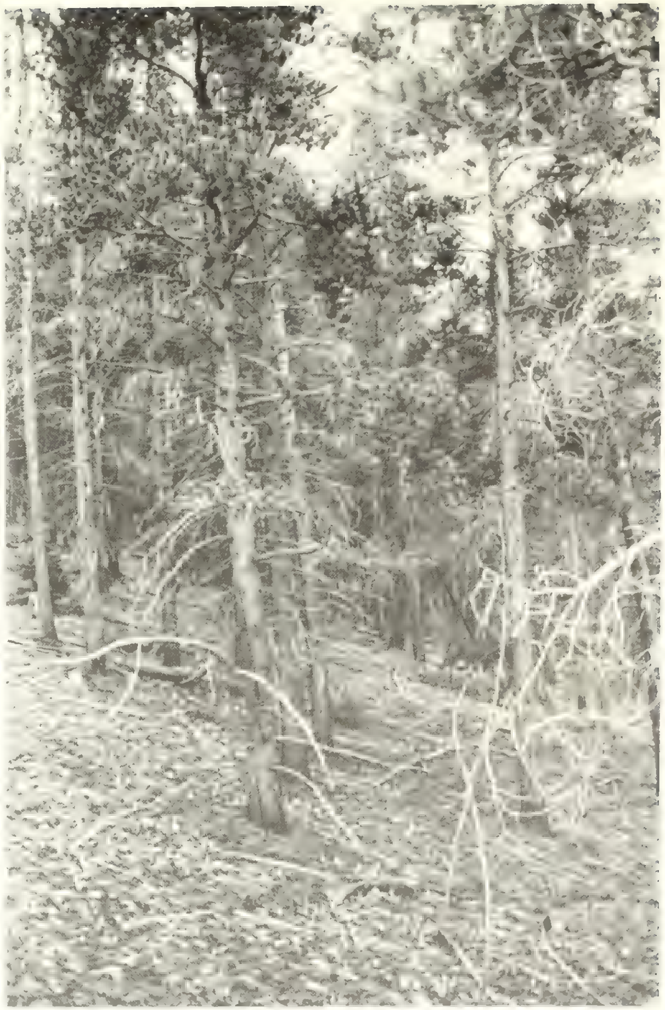

Figure 2-15—In the Tennessee Pass area of the White River National Forest these trees 6 to 12 inches in diameter, in a somewhat open stand, tended to retain limbs.

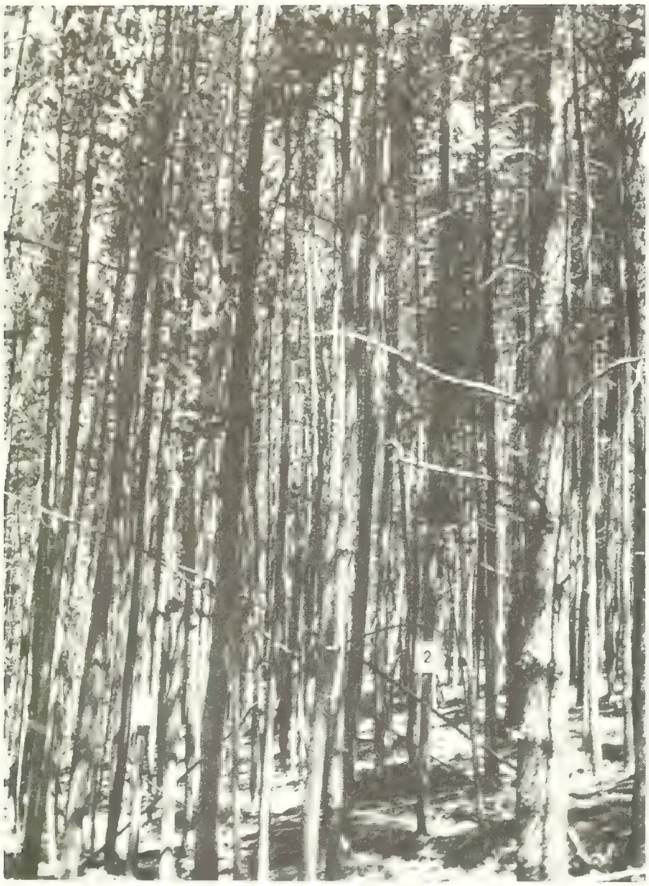

Figure 2-16—Pair of codominant sample trees 3½ to 4 inches in d.b.h. in pole stand at about 10,000 feet near the prominent switchback on the Pearl Creek Road just east of Camp Hale in the Tennessee Pass area of the White River National Forest. Such trees are typical of lodgepole pine found on the medium-elevation forested benches of the area.

Characteristic	Tree number 1	Tree number 2
D.b.h. (outside bark), inches	3.80	3.70
Tree height above 6-inch high stump, feet	38.7	39.3
Crown ratio, percent	24	38
Cone serotiny	no cones	closed
Tree age years (number of annual growth rings)		
Stump height	132	130
20 percent of tree height	112	120
Base of live crown	52	70
Diameter inside bark, inches		
Stump height	3.90	3.66
20 percent of tree height	3.29	3.28
Base of live crown	1.89	2.32
Height from stump top to base of crown, inches	351	292
Stem taper inside bark, inches/100 inches		
Below crown	0.57	0.46
Within crown	1.67	1.29
Rings/inch, average for section		
Stump height	68	71
Base of live crown	55	60
Properties of stemwood at 20 percent height		
Moisture content, percent ovendry weight	80.6	73.2
Specific gravity, ovendry weight and green volume	0.421	0.427
Rings/inch in first 1¼ inches radius	40	48
Maximum crushing strength, lb f/in²	5,660	6,270
Proportional limit, lb f/in²	3,830	4,640
Modulus of elasticity, lb f/in²	1,150,000	1,150,000
Compression wood evident?	none	none
Spiral grain angle at surface, degrees	0	8
Bark thickness (single), inch	0.11	0.09
Pith eccentricity, inch	0.2	0.2

Inventory Data—The entire area has been timber-type mapped, but inventory data are incomplete. Like most other lodgepole pine forests, the timber varies in a continuum from one type to another. At the risk of oversimplification, managers responsible for the area suggest the following generalized stand-table data as representative of pole stands on benches (fig. 2-16), and more open stands of larger trees (fig. 2-15); probably the larger timber type predominates, with tree heights of 50 to 60 feet:

D.b.h. class	Pole timber type	Larger-timber type
Inches	*Number of live lodgepole stems per acre*	
<2.9	100 (cull)	200 (cull)
3.0-4.9	125	0
5.0-6.9	120	20
7.0-8.9	40	95
9.0-10.9	25	65
11.0+	15	25
Total	425	405

Cubic Yield Potential and Height Growth—Site productivity estimated on 114 lodgepole pine plots in the area averaged 32 ft^3 of stemwood per acre per year, with most in the range from 22 to 42 ft^3. Fifty-year height growth in managed stands is estimated to be 35 to 40 feet.

Management Objectives for the Area and Constraints—Diversity of age classes in the lodgepole pine stands is desired. Species diversity (to include spruce and alpine fir) is also desired.

While it is important to maintain visual esthetic values, and to improve wildlife habitat and watershed quality, these values are not seen as significantly constraining harvest. Lack of markets for stumpage is the primary constraint to management. In 1985 and 1986 the National Forest received about $6 per M bd ft Scribner scale for lodgepole pine sawtimber stumpage and $5 per cord for firewood (dead timber only) from the area. Revenues from sawtimber stumpage were generally less than the full cost of preparing sawtimber sales in the area.

Other Lodgepole Pine Available in the Area From Public Lands—In addition to the approximately 11,000 acres of lodgepole pine in the Tennessee Pass area of the

Holy Cross Ranger District, the Leadville Ranger District immediately south of Tennessee Pass has as much or more acreage of lodgepole pine.

Forest Products Industry in the Vicinity—There are no major wood-consuming industries in the immediate vicinity of the Tennessee Pass area. The nearest operation utilizing large tonnages of lodgepole pine is a structural flakeboard plant 90 miles to the north in Kremmling, CO.

Population in the Vicinity—Lake County has a total population of 9,980 (1981). Population within the limits of the town of Leadville totals 5,024 (1985). During 1985, unemployment rate for Lake County averaged 13.2 percent. Annual per-capita income in Lake County in 1984 was $8,612.

Eagle County had a population of 13,171 in 1980, and the town of Minturn had a population of 1,060. In 1984, annual per-capita income in Eagle County was $14,161. During 1985 the unemployment rate averaged 5.5 percent in the county.

STATE FOREST

Area Name and Location—The south end area (figs. 2-17, 2-18, and 2-19) of the Colorado State Forest lies from 9,000 to 10,000 feet at latitude 40°34' and longitude 105°58'. It is administered from the headquarters office just east of Gould.

While the area delineated in figure 2-18 is only about 6,000 acres, there is in the vicinity a total of about 16,000 contiguous acres of similar State Forest land. Of this 16,000 acres, about 70 percent is in meadows, aspen, and spruce—leaving about 30 percent or 4,800 acres in lodgepole pine type. The area is centered northwest of the Bockman Lumber Camp site (now out of operation), about 45 air miles due west of Fort Collins and 22 air miles

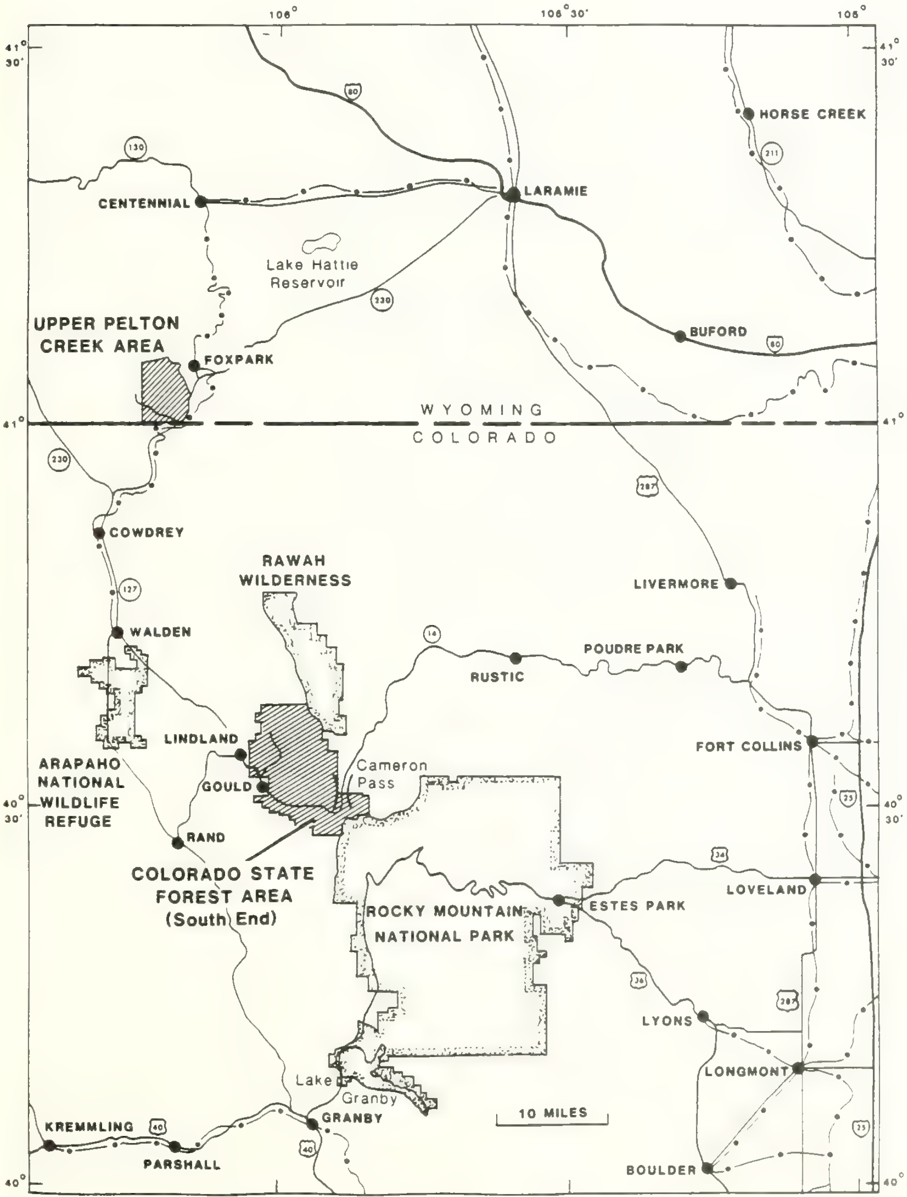

Figure 2-17—Vicinity map for the south end area of the Colorado State Forest and the Upper Pelton Creek area of the Medicine Bow National Forest in Wyoming.

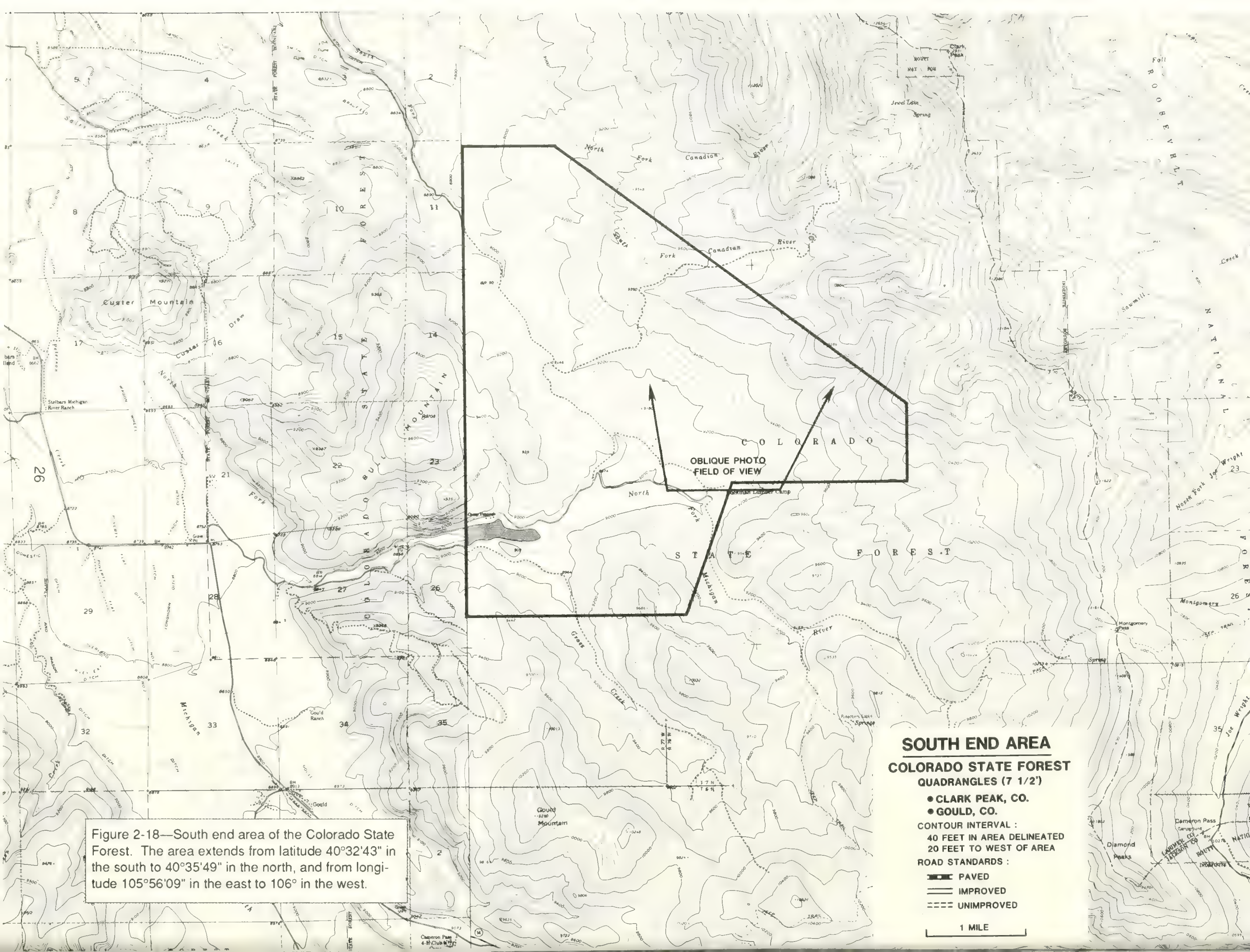

Figure 2-18—South end area of the Colorado State Forest. The area extends from latitude 40°32'43" in the south to 40°35'49" in the north, and from longitude 105°56'09" in the east to 106° in the west.

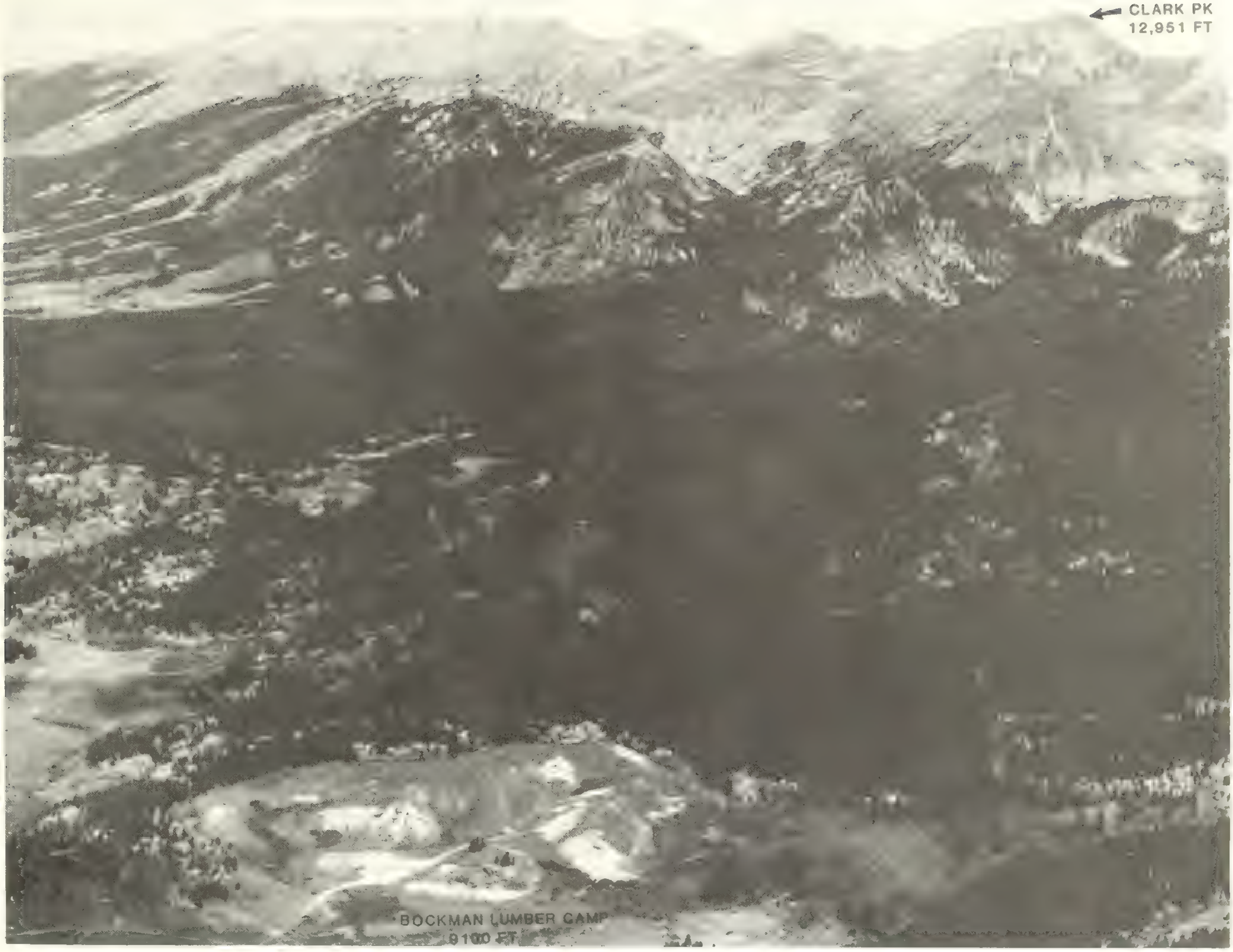

Figure 2-19—View in the south end of the Colorado State Forest from just south of Bockman Lumber Camp looking north-northwest toward the crest of the Medicine Bow Mountains. From Bockman Lumber Camp to Clark Peak is 3.8 miles.

southeast of Walden on a heading of 128°. The crest of the Medicine Bow Mountains is immediately east of the area.

The area is in Jackson County; Walden is the county seat.

Maps of the Area—USGS quadrangle 7½' maps needed to depict the area are: Clark Peak and Gould.

Access—Access to the area is from State Highway No. 14 a couple of miles north of Gould, via a secondary improved road into Michigan Reservoir on the North Fork of the Michigan River. Road distance from State Forest headquarters near Gould to Bockman Lumber Camp site is about 10 miles. From Bockman Lumber Camp site, unimproved roads run into both northeastern and northwestern parts of the area (fig. 2-18).

Walden (elevation 8,300 feet), about 26 road miles from the Bockman site, is the nearest railhead. A more distant railhead is Granby, 57 road miles south via Rand. The railhead at Fort Collins is 92 road miles distant via 10,285-foot Cameron Pass.

For highway distances from Fort Collins to various market centers in the United States, see table 1-2.

Terrain and Soil—As previously noted, the timbered area lies mostly between 9,000 and 10,000 feet, with about three-quarters of the lodgepole pine timber on slopes less than 45 percent. Soils, derived from glacial tills and weathered basalt flows, are deep and well drained.

Annual Precipitation and Duration of Snow-free Season—Annual precipitation totals about 25 inches, with 3 to 4 feet of snow on the ground common in winter. Snow-free season is generally mid-June through mid-September.

General Character of the Timber—About 20 percent of the 4,800 acres of lodgepole pine forest type in the area is in uneven-aged stands residual from logging activities prior to 1960; these stands (fig. 2-20), mostly located within the area delineated in figure 2-18, are heavily infested with dwarf mistletoe.

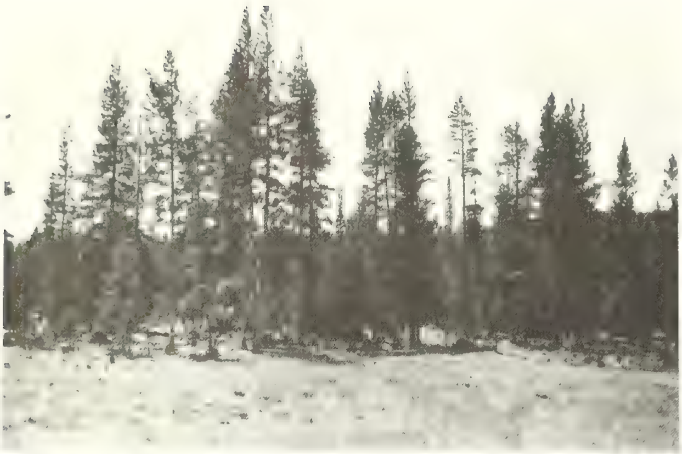

Figure 2-20—Uneven-aged, mistletoe-infested, high-graded forest residual from prior-to-1960 logging activities on the south end area of the Colorado State Forest. This forest type is representative of about 20 percent of the lodgepole pine type forest in the south end area.

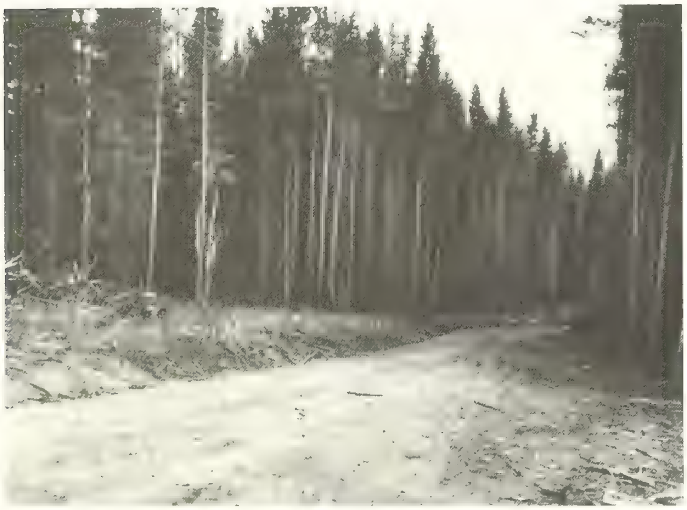

Figure 2-21—Even-aged pole stand 100+ years old representative of about 80 percent of the lodgepole pine type acreage on the south end of the Colorado State Forest. These trees are mostly 3 to 7 inches in d.b.h, with some as large as 10 to 11 inches; few would exceed 50 feet in height.

The remaining 80 percent of the 4,800 acres of lodgepole pine carries 100+-year-old pole stands, with trees mostly 3 to 7 inches in d.b.h.—but with some trees as large as 10 to 11 inches (fig. 2-21).

Clumps and stringers of aspen are common throughout the lodgepole-type forest.

At present, mortality from mountain pine beetle attacks is not evident, and there is little porcupine damage. Comandra rust has caused cankers in some trees and dwarf mistletoe is plentiful—particularly in the stands high-graded by loggers.

Loggers were most active in the area during the 1930's, and significant harvesting continued until 1960. Currently, only posts and poles for local use are harvested. The area has few trees large enough to interest sawmillers.

Data on Sample Trees—To provide more than casual observational data descriptive of the trees, a pair of adjacent 3½- to 4-inch codominant trees were destructively sampled at 9,100 feet from near-level terrain about 3 miles northwest of Bockman Lumber Camp site. Some pertinent tree characteristics follow. These tabulated data should not be interpreted as statistically representive of all trees.

See appendix for an explanation of tree selection and procedures for evaluation of mechanical properties in compression parallel to the grain at 10 percent moisture content.

Characteristic	Tree number 1	Tree number 2
D.b.h. (outside bark), inches	3.40	3.92
Tree height above 6-inch high stump, feet	39.5	43.0
Crown ratio, percent	35.7	55.8
Cone serotiny	closed	closed
Tree age years (number of annual growth rings)		
Stump height	100	101
20 percent of tree height	78	80
Base of live crown	53	66
Diameter inside bark, inches		
Stump height	3.60	4.12
20 percent of tree height	3.00	3.40
Base of live crown	1.95	2.82
Height from stump top to base of crown, inches	305	228
Stem taper inside bark, inches/ 100 inches		
Below crown	0.54	0.62
Within crown	1.15	0.98
Rings/inch, average for section		
Stump height	56	49
Base of live crown	38	47
Properties of stemwood at 20 percent height		
Moisture content, percent ovendry weight	72.7	80.2
Specific gravity, ovendry weight and green volume	0.424	0.404
Rings/inch in first 1¼ inches radius	38	30
Maximum crushing strength, lb f/in^2	6,330	5,160
Proportional limit, lb f/in^2	5,500	4,540
Modulus of elasticity, lb f/in^2	1,470,000	1,030,000
Compression wood evident?	none	none
Spiral grain angle at surface, degrees	7	3
Bark thickness (single), inch	0.10	0.10
Pith eccentricity, inch	none	0.2

Inventory Data—Inventory fieldwork for the area was initiated in 1986, but data were not available in time for inclusion in this report. As noted previously, about 80 percent of the lodgepole pine acreage is in 100+-year-old pole stands. Managers responsible for the area estimate typical stand data for these acres as follows (tree height averages about 50 feet):

D.b.h. class *Inches*	Pole timber type *Number of live stems per acre*
<2.9	300
3.0-3.9	290
4.0-4.9	295
5.0-5.9	100
6.0-6.9	200
7.0-7.9	150
8.0+	80
Total	1,415

Cubic Yield Potential and Height Growth—Although data are not well documented, area managers estimate that current growth is about 19 ft^3 of stemwood per acre per year; for managed stands it should be about 25 ft^3 per acre per year. Fifty-year height growth in managed stands is estimated to be about 35 feet.

Management Objectives for the Area and Constraints—Objectives include: improvement of general stand health and vigor, enhancement of wildlife habitat, contributions to all recreation uses occurring on the State Forest, maintenance of water quality and quantity, enhancement of esthetic values, sustained production of wood, enhancement of domestic-animal grazing, and enhancement of forestry education potential.

The primary obstacle to forestry practices for accomplishment of the objectives is lack of markets for small-diameter lodgepole pine. At considerable risk of oversimplification, following are approximate lodgepole pine stumpage prices obtained by the State in 1985 and 1986 from this area: sawtimber, $6 to $16 per M bd ft Scribner scale; dead timber for firewood, $5 per cord; Christmas trees, $5 per tree. Revenues from timber sales (as well as those from grazing, recreation, fishing, and hunting) help fund the school system of the State.

Other Lodgepole Pine Available in the Area From Public Lands—Additional lodgepole pine acreage administered by the Routt National Forest and by the Bureau of Land Management lies to the south of the Colorado State Forest, but the extent and availability of this acreage was not investigated.

Forest Products Industry in the Vicinity—A major sawmill producing random-length dimension lumber operates in Walden, and structural flakeboard utilizing lodgepole pine is manufactured in Kremmling—about 80 road miles southwest of Bockman Lumber Camp site. In Fort Collins there are plants manufacturing log homes, posts and poles, shingles, and lumber—but the operations are small.

Population in the Vicinity—In 1983 Jackson County had a population of about 1,800. Population of Walden in 1984 was 872. Annual per-capita income in Jackson County was $10,788 in 1985. Since 1980 the unemployment rate in Jackson County has varied from 5 to 9 percent.

The railhead city of Fort Collins (population 82,150) is in Larimer County where total population is 171,700 (1985). In 1986, 4.1 percent of the workforce in the county was unemployed. Annual per-capita income in Fort Collins was $10,514 in 1984.

BUREAU OF LAND MANAGEMENT FOREST

Area Name and Location—The Rock Creek area (figs. 2-7, 2-22, and 2-23), which lies at elevations from 9,500 to 10,500 feet at latitude 38°13' and longitude 106°58', is in the Montrose District of the Bureau of Land Management in Colorado. The administrative office for the area is in Gunnison.

The gross timbered area totals about 8,900 acres, of which about 90 percent is lodgepole pine type. The area is almost entirely within Saguache County (Saguache is the county seat) but has a small acreage in Gunnison County (Gunnison is the county seat). The area is centered around Summit Park and Rock Creek Park. It is 60 air miles due north of Pagosa Springs and 25 air miles south-southwest of Gunnison on a heading of 191°. Private land is interspersed with that administered by the Bureau of Land Management (fig. 2-22).

Maps of the Area—USGS quadrangle 7½' maps needed to depict the area are: Rock Creek Park, Rudolph Hill, Powderhorn, and Spring Hill Creek.

Access—The western portion of the area (vicinity of Polepatch Hill) is reached by road as follows (38 miles):

Gunnison to Blue Mesa Bridge via U.S. Highway No. 50	10 miles
Blue Mesa Bridge south on paved road to County Road No. 27	18 miles
County Road 27 (gravel) east to start of Road Beaver	4 miles
Road Beaver to start of North Beaver Creek Road	2 miles
Unimproved Road Beaver (from the North Beaver Creek junction) to the area border	4 miles

The northwest corner of the area is reached by about 3 miles of unimproved road up North Beaver Creek. The southern border of the area is reached by an improved road running north from the Los Pinos Pass road; an unimproved road extends to the eastern border. The northernmost portion of the area is not accessible by road (fig. 2-22).

The nearest railhead is Poncha Springs on a spur extending about 5 miles from Salida. For highway distances from Salida to various market centers in the United States, see table 1-2.

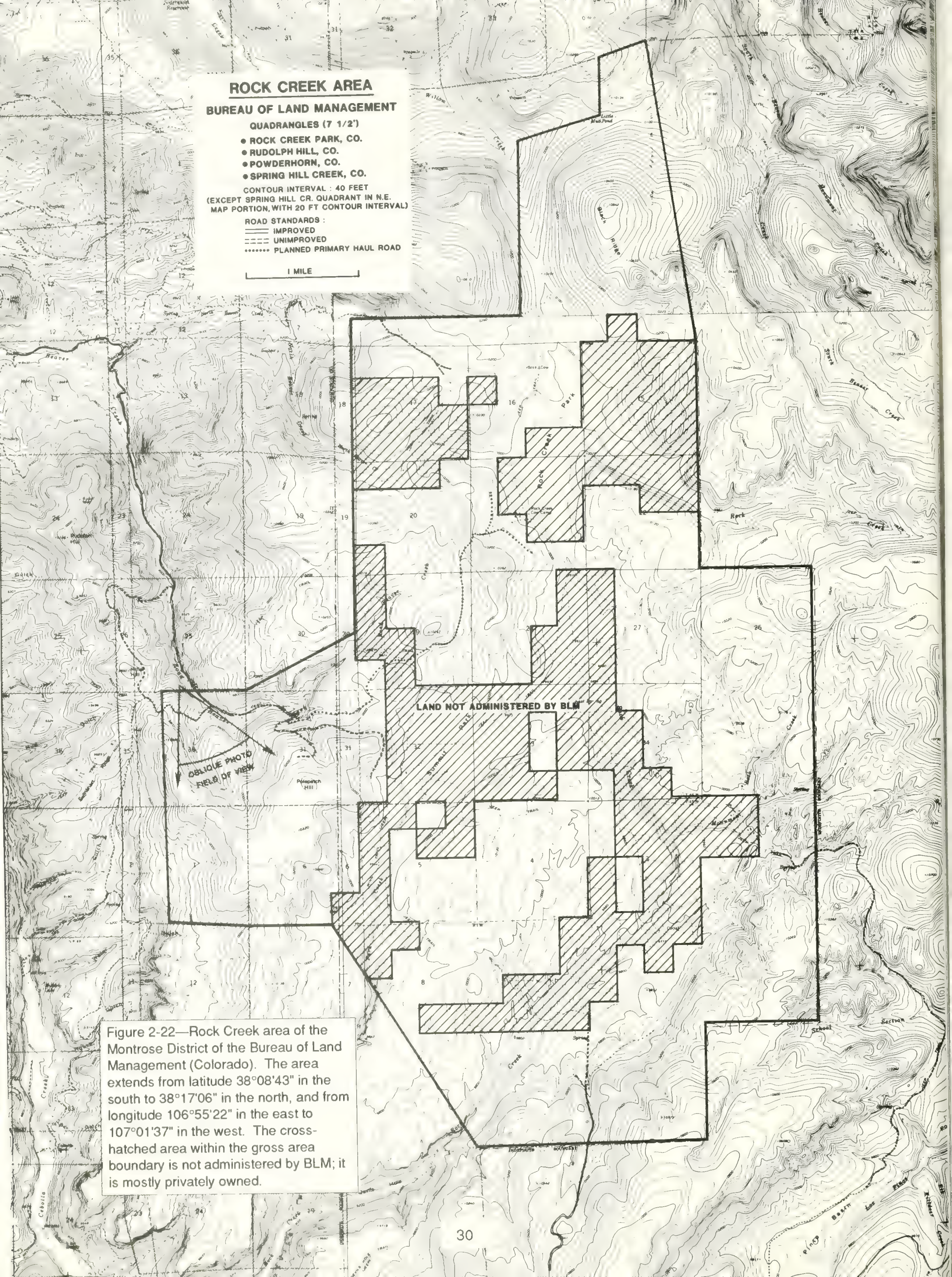

Figure 2-22—Rock Creek area of the Montrose District of the Bureau of Land Management (Colorado). The area extends from latitude 38°08'43" in the south to 38°17'06" in the north, and from longitude 106°55'22" in the east to 107°01'37" in the west. The cross-hatched area within the gross area boundary is not administered by BLM; it is mostly privately owned.

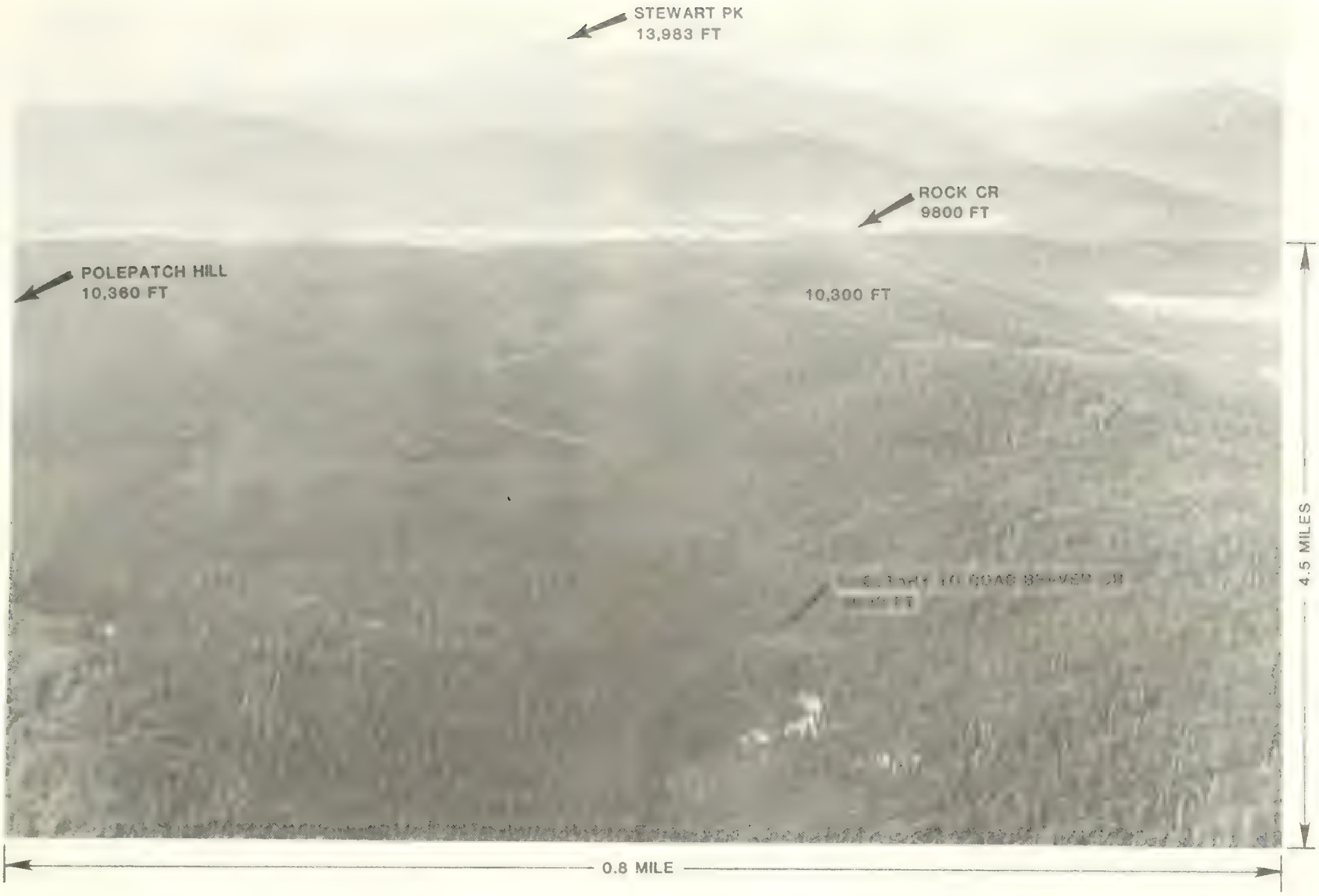

Figure 2-23—Oblique view of the Rock Creek area of the Montrose District of the Bureau of Land Management (Colorado) looking south-southeast from near Miller Hill; see figure 2-22 for camera viewpoint and field of view. Width of the foreground shown is about 0.8 mile; from foreground to Rock Creek in the mid-background is about 4½ miles.

Terrain and Soil—As previously noted, the timbered area lies mostly between 9,500 and 10,500 feet, with about 80 percent of the lodgepole pine timber type on slopes of less than 45 percent (fig. 2-23). Soils are gravelly sandy loam. Duff layer in the Polepatch Hill area was observed to be about 1 inch thick.

Annual Precipitation and Duration of Snow-free Season—Annual precipitation is about 20 inches, with 1 to 1½ feet of snow on the ground common in midwinter. The snow-free season generally extends from mid-May through November.

General Character of the Timber—The lodgepole stands grade in continuums from stand to stand, but three stand types predominate: small sawtimber 7 to 12 inches in d.b.h. (fig. 2-24); pole stands with trees predominantly 3 to 4 inches in d.b.h. (fig. 2-25); and stagnated stands of small trees predominantly 1 to 3 inches in d.b.h. (fig. 2-26). Small sawtimber occurs on about 45 percent of the lodgepole pine acreage, pole stands on 40 percent, and "doghair" stands on about 5 percent.

There were extensive fires in the area 100 to 150 years ago; trees in current lodgepole pine stands are 95 to 130 years old.

At present, mortality caused by mountain pine beetle is not evident, nor is damage from porcupines. Dwarf mistletoe is absent, but some trees are cankered from various rusts, and butt scars from fire are evident in the Polepatch Hill area (fig. 2-24).

There has been no harvesting in the area except for a couple of hundred acres of small sawtimber harvested (107 acres clearcut and 84 acres in a partial cut) during 1986; the logs were transported about 100 miles to a flakeboard mill near Montrose.

Data on Sample Trees—To provide more than casual observational data descriptive of the trees, a pair of adjacent 3½- to 4-inch codominant trees were destructively sampled from a gentle slope north of Polepatch Hill (fig. 2-25). Some pertinent tree characteristics follow. These tabulated data should not be interpreted as statistically representative of all trees.

See appendix for an explanation of tree selection and procedures for evaluation of mechanical properties parallel to the grain at 10 percent moisture content.

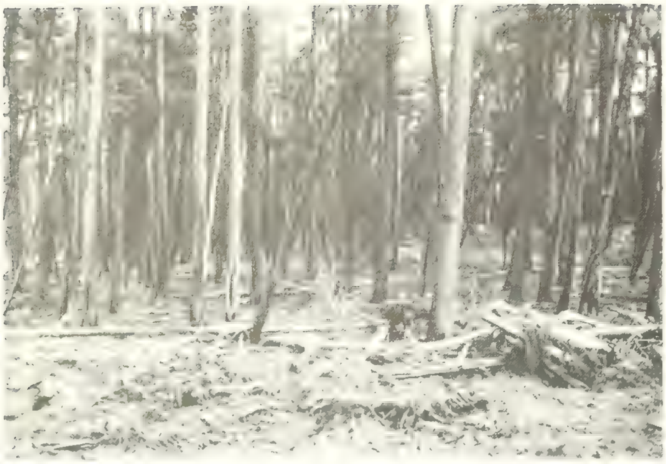

Figure 2-24—Lodgepole pine stand with some small sawtimber on Polepatch Hill of the Rock Creek area of the Montrose District of the Bureau of Land Management in Colorado. Fire scars are evident on butts of many trees here.

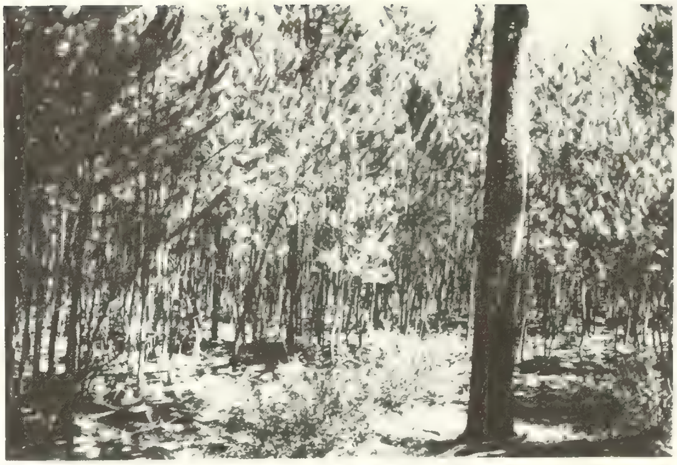

Figure 2-26—Stagnant stand of small lodgepole pine on Polepatch Hill of the Rock Creek area of the Montrose District of the Bureau of Land Management in Colorado. Trees measured 1 to 3 inches in d.b.h.

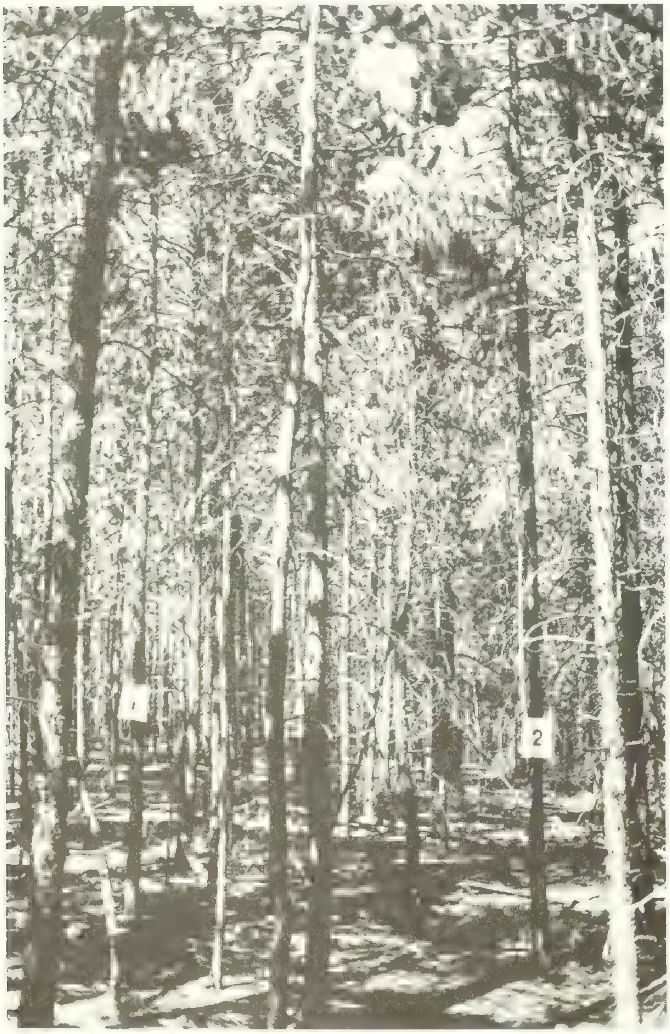

Figure 2-25—Pair of codominant lodgepole pines 3$\frac{1}{2}$ to 4 inches in d.b.h. sampled on Polepatch Hill in the Rock Creek area of the Bureau of Land Management.

Characteristic	Tree number 1	Tree number 2
D.b.h. (outside bark), inches	3.80	3.88
Tree height above 6-inch high stump, feet	24.3	29.3
Crown ratio, percent	43.1	39.5
Cone serotiny	closed	closed
Tree age years (number of annual growth rings)		
Stump height	110	102
20 percent of tree height	100	83
Base of live crown	50	51
Diameter inside bark, inches		
Stump height	3.70	4.10
20 percent of tree height	3.39	3.53
Base of live crown	2.32	2.77
Height from stump top to base of crown, inches	204	213
Stem taper inside bark, inches/100 inches		
Below crown	0.68	0.62
Within crown	2.64	1.99
Rings/inch, average for section		
Stump height	59	50
Base of live crown	43	37
Properties of stemwood at 20 percent height		
Moisture content, percent ovendry weight	99.3	104.7
Specific gravity, ovendry weight and green volume	0.395	0.398
Rings/inch in first 1$\frac{1}{4}$ inches radius	46	30
Ultimate compresssive strength, lb f/in^2	5,270	4,990
Proportional limit, lb f/in^2	3,970	3,760

Characteristic	Tree number 1	Tree number 2
Modulus of elasticity, lb f/in^2	1,060,000	1,120,000
Compression wood evident?	none	slight
Spiral grain angle at surface, degrees	2	1
Bark thickness (single), inch	0.16	0.14
Pith eccentricity, inch	0.1	0.4

Inventory Data—Stand inventory data from 322 plots taken in 1981 and 1982 indicate that the basal area per acre averages 97 ft^2 (range 22 to 313), volume per acre in trees larger than 9 inches in d.b.h. averages 3,000 bd ft Scribner scale (range 1 to 24), and tree height averages 45 feet (maximum 116). For the Rock Creek study area sampled, diameter distribution averaged as follows:

D.b.h. class *Inches*	Lodgepole pine *Number of trees per acre*
<5.0	196
5.0-5.9	50
6.0-6.9	54
7.0-7.9	40
8.0-8.9	25
9.0-9.9	17
10.0-10.9	14
11.0-11.9	10
12.0-12.9	7
13.0-13.9	5
14.0-14.9	2
15.0-15.9	2
16.0+	2
Total	424

Cubic Yield Potential and Height Growth—Although not well documented, growth on the area is estimated at something more than 20 ft^3 per acre per year. Fifty-year height growth in managed stands is estimated to be about 31 feet (range 15 to 57).

Management Objectives for the Area and Constraints—The long-term management objective for the area is to convert the presently unmanaged lodgepole stands to managed stands through regeneration-harvest methods and intermediate cutting treatments where appropriate. The protection and enhancement of big game habitat is also a primary objective. The area is managed for multiple use, and harvest plans will be evaluated for effects on the environment.

The primary obstacle to forest practices for accomplishment of objectives is lack of markets for stumpage. In 1986, sawtimber stumpage was sold at $10 per M bd ft Scribner log scale—a price insufficient to return the full cost of sawtimber sale preparation; moreover, there are few interested buyers even at this price. Subsawlog-size trees have virtually no market.

Other Lodgepole Pine Available in the Area From Public Lands—While not studied intensively, it is believed that additional large acreages of lodgepole pine are unavailable on other public lands in the vicinity.

Forest Products Industry in the Vicinity—There are no large forest industries immediately adjacent to the area. Major timber consumers in the region include a large sawmill cutting random-length dimension lumber, and a structural flakeboard plant—both near Montrose. A house log manufacturer operates in Poncha Springs.

There are three very small sawmills in Saguache. Monte Vista has a medium-size sawmill; Alamosa has a moderately large mill; and South Fork has a large stud mill and a medium-size sawmill for random-length dimension lumber. A small industry producing mine props and house logs operates in Creede.

Population in the Vicinity—As noted in comments about the Gunnison National Forest area, Gunnison County has a total population of 11,286 (1983), almost all of whom reside within 30 miles of Gunnison—the home of Western State College. Population within the limits of the town of Gunnison totals 5,902. In 1983 the per-capita income in Gunnison County was $7,874, with 5.9 percent of the workforce unemployed. Gunnison is a major tourist center.

As noted in comments on the Rio Grande National Forest, Saguache County has a total population of 3,946 (1985); population within the town of Saguache totals 625. In 1980 the per-capita income of Saguache County was $4,504, with 16 percent of the workforce unemployed in 1985.

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Van Hooser, Dwane D.; Chojnacky, David C. 1983. Whole tree volume estimates for the Rocky Mountain States. Resour. Bull. INT-29. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 69 p.

CHAPTER 3: IDAHO

INTRODUCTION

In Idaho, lodgepole pine predominates on about 2.3 million acres of the State's 14.0 million acres of commercial forest land, with about 4.1 billion ft^3 of lodgepole pine growing stock and 11.6 billion bd ft of sawtimber (table 3-1). Approximately 13 percent of the softwood growing stock and 8 percent of the softwood sawtimber in the State is lodgepole pine (Benson and others 1987).

Approximately 52 percent of the dry weight of aboveground biomass of lodgepole pine trees in Idaho is in trees smaller than the 10-inch d.b.h. class (table 3-2).

The six areas selected for study by managers of the public forest lands in Idaho (fig. 3-1) total 78,840 acres in gross area; they are individually described in the following text.

Table 3-1—Volume of lodgepole pine growing stock and sawtimber, and acreage in lodgepole pine, by ownership class, Idaho[1]

Ownership class	Growing stock[2]	Sawtimber volume[3]	Commercial timberland area
	Million ft^3	*Million bd ft International ¼-inch scale*	*Thousand acres*
National Forest (commercial)[4]	3,292.9	9,414.1	1,882.0
Other public	263.8	722.4	129.0
Forest industry	136.5	395.4	56.3
Other private	386.1	1,088.1	191.0
Total	4,079.3	11,620.0	[4]2,258.3

[1] Source: Benson and others (1987). Information presented is based on 1981 data.

[2] **Growing stock volume** = net volume in cubic feet of live sawtimber and pole timber trees (5 inches d.b.h. and larger) from stump to a minimum 4-inch top outside bark, or to the point where the central stem breaks into limbs.

[3] **Sawtimber volume** = net volume in board feet of the sawlog portion of live sawtimber trees. Sawtimber trees are live trees of commercial species, 9 inches in d.b.h. or larger (softwood), containing at least one 12-foot sawlog or two noncontiguous 8-foot sawlogs, and meeting regional specifications for freedom from defect.

[4] **Commercial timberland** = forest land that is capable of producing crops of industrial wood and not withdrawn from timber utilization by statute or administrative regulation. Areas qualifying as commercial timberland have the capability of producing in excess of 20 ft^3 per acre per year of industrial wood in natural stands.

Table 3-2—Dry weight of lodgepole pine trees, by tree component and diameter class—Idaho[1]

Diameter class	Bole[2]	Top[2]	Total
Inches	*- - - Thousand tons, ovendry basis - - -*		
2	—	1,237	1,237
4	—	6,200	6,200
6	9,319	5,470	14,789
8	13,614	3,567	17,181
10	12,631	2,908	15,539
12	8,289	2,054	10,343
14	4,338	962	5,300
16	2,320	500	2,820
18	1,130	216	1,346
20+	772	155	927
Total	52,413	23,269	75,682

[1] Source: Van Hooser and Chojnacky (1983).

[2] **Trees 5+ inches d.b.h.**: Bole weight = ovendry weight of wood and bark from a 1-foot stump to a 4-inch top diameter, inside bark; top weight = ovendry weight of wood and bark from a 4-inch diameter to tip of tree, plus branch material down to ¼-inch diameter.

Trees less than 5 inches d.b.h.: Total ovendry weight of wood and bark from a 1-foot stump to tip of tree, plus branch material down to ¼-inch diameter (tabulated under "Top").

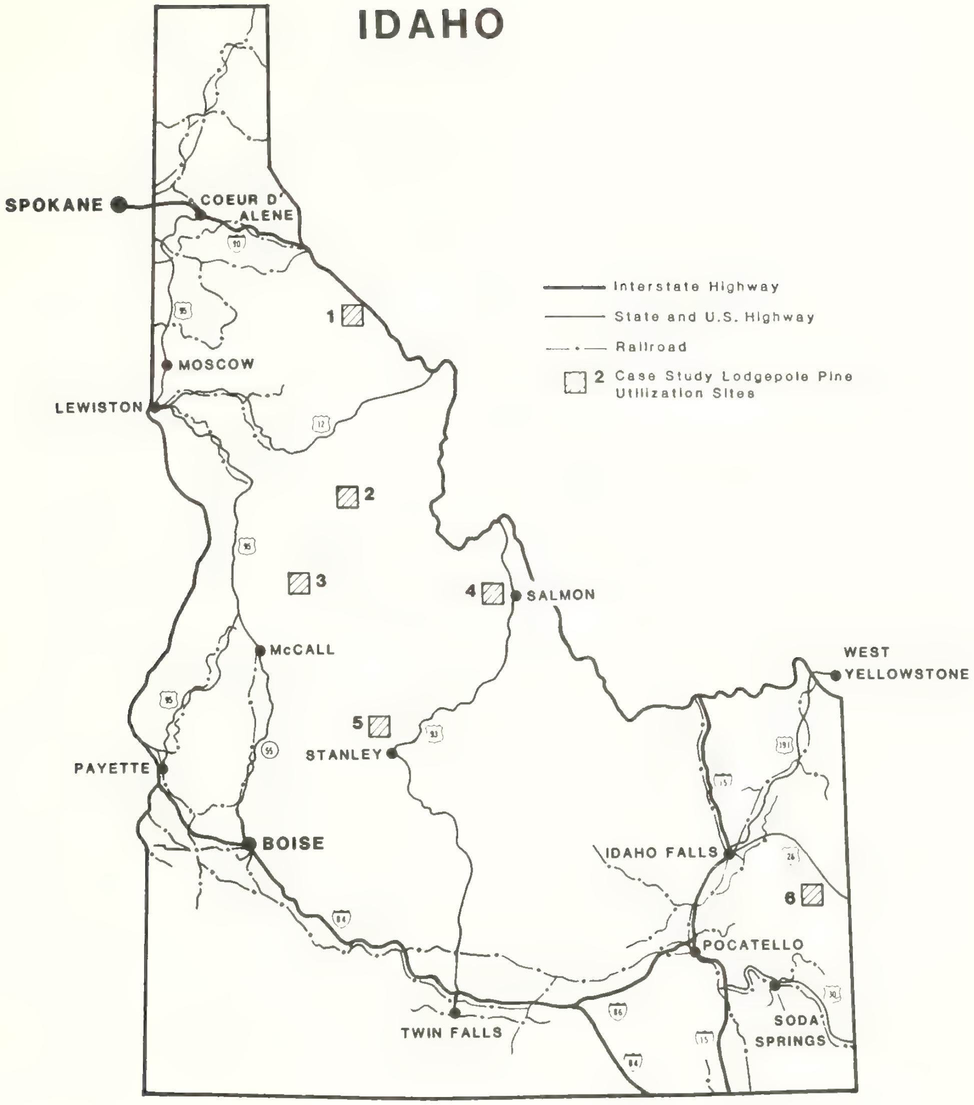

Figure 3-1—Idaho location map. 1. Panhandle NF (Wampus, Goat, Blackburn, and Heller Creeks) 3,900 acres. 2. Nez Perce NF (Kirks Fork) 5,040 acres. 3. Payette NF (Stratton Creek) 7,800 acres. 4. Salmon NF (Leesburg Basin) 31,700 acres. 5. Challis NF (Cape Horn) 3,400 acres. 6. Caribou NF (Brockman Road) 27,000 gross acres, of which about two-thirds are roadless; in roaded areas there are about 2,500 acres of lodgepole pine type forest.

CARIBOU NATIONAL FOREST

Area Name and Location—The Brockman Road area (figs. 3-2, 3-3, and 3-4), which lies at an elevation of 6,500 to 7,500 feet at latitude 43°11' and longitude 111°17', is in the Soda Springs District of the Caribou National Forest in Idaho. The Ranger Station is in Soda Springs.

The gross area is about 27,000 acres, but approximately two-thirds of these acres are unroaded and are mostly in grassland. Only about 2,500 acres are timbered in lodgepole pine type—all to the west of the major access road (Brockman Road) (fig. 3-3). The area falls entirely within Bonneville County; Idaho Falls is the county seat.

The center of the area is about 14 miles due west of Alpine and the south end of Palisades Reservoir; it is 39 air miles north-northeast of Soda Springs on a heading of 24°.

Maps of the Area—USGS quadrangle 7$^1/_2$' maps needed to depict the area are: Herman, Big Elk Mountain, and Poker Peak.

Access—A dry-weather unimproved road (Brockman Road) gives access to the slopes along the grassy lower edge of the forested portion which lies along the western edge of the gross area (fig. 3-3). Caribou Basin Guard Station on the southern edge of the area (where Brockman Road joins the McCoy Creek Road) is 54 highway miles from Soda Springs and 19 miles to U.S. Highway No. 89 at Alpine.

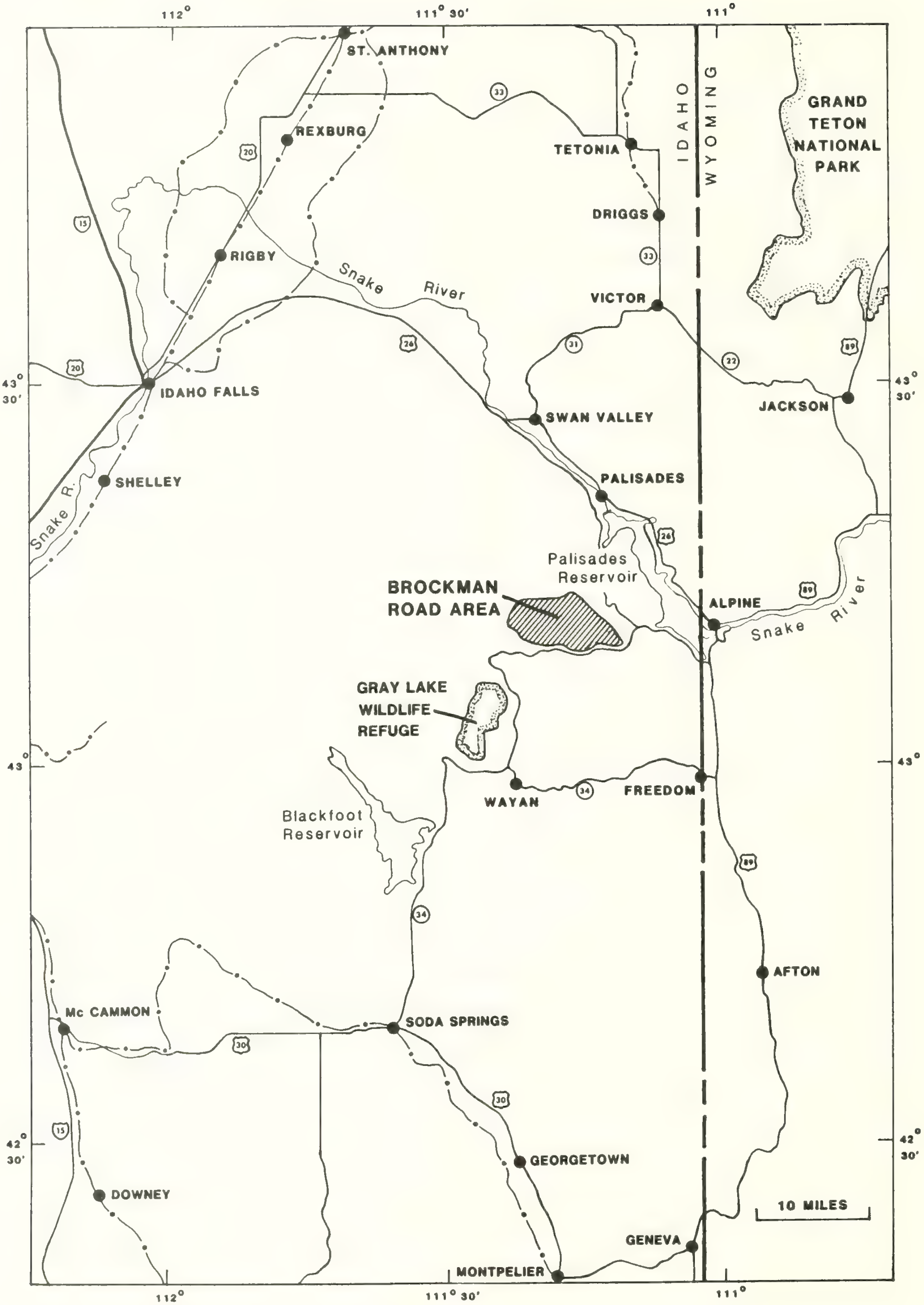

Figure 3-2—Vicinity map for the Brockman Road area of the Caribou National Forest in Idaho.

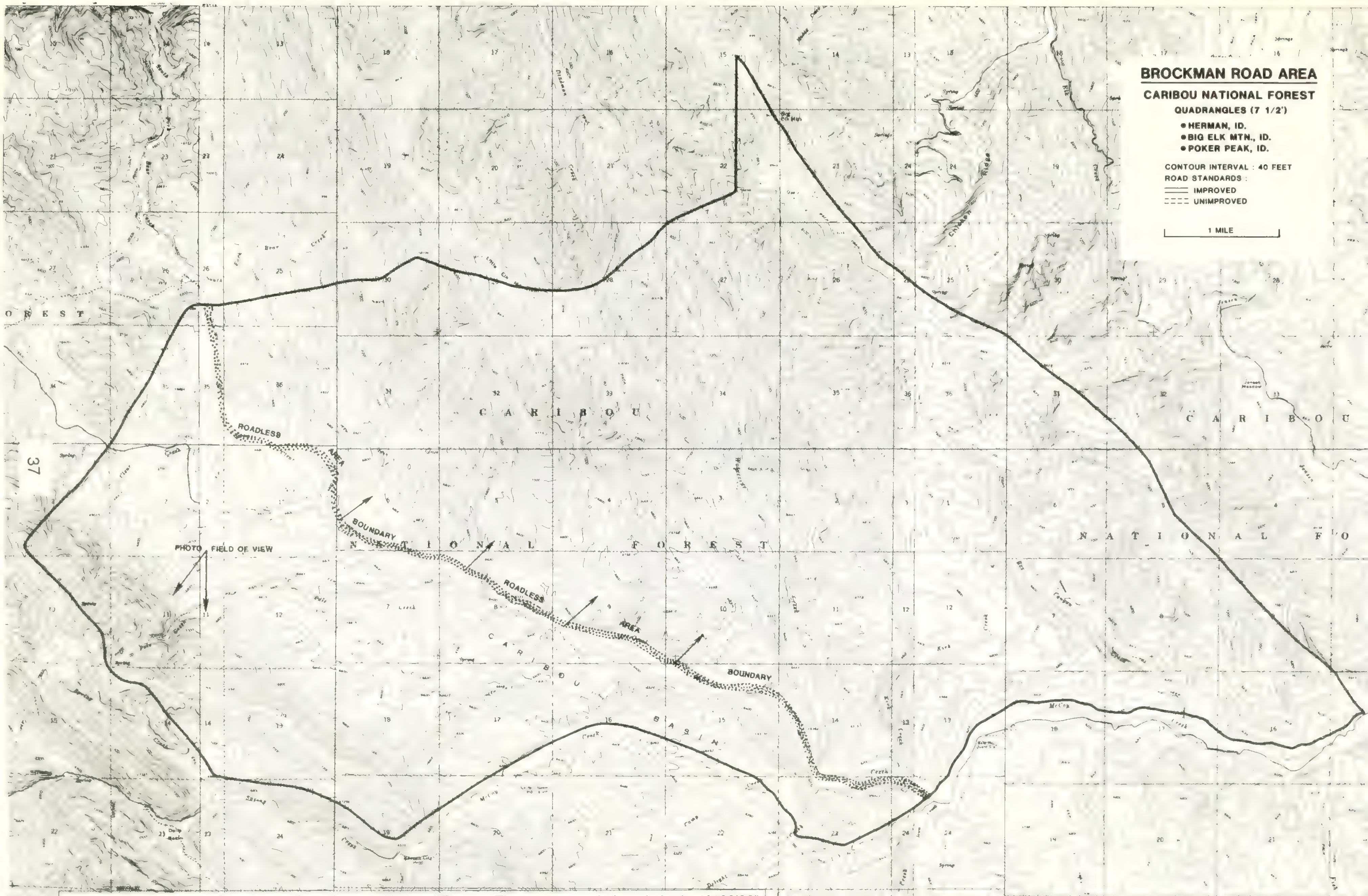

Figure 3-3—Brockman Road area of the Caribou National Forest. The area extends from latitude 43°08'32" in the south to 43°14'38" in the north, and from longitude 111°10'13" in the east to 111°24'20" in the west.

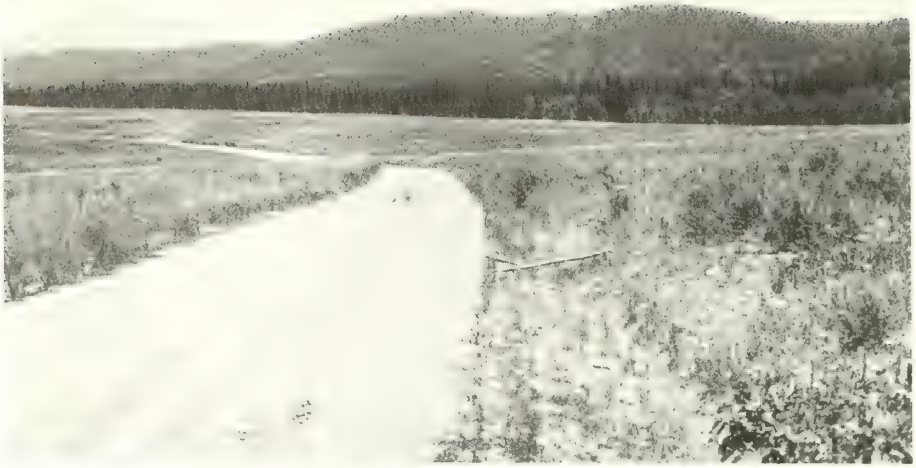

Figure 3-4—View looking west from the access road in the north end of the Brockman Road area of the Caribou National Forest. The lodgepole pine is interspersed with stands of aspen. The ridge in the near background (the west border of the area) has maximum elevation of 7,500 feet. Meadows in the foreground are at 6,500 to 6,700 feet elevation. See figure 3-3 for approximate viewpoint and field of view.

The nearest railhead is Soda Springs. A more distant railhead is Idaho Falls, which is about 120 road miles from the Caribou Basin Guard Station via Alpine and U.S. Highway No. 89 (somewhat closer via Herman and Bone). For highway distances from Idaho Falls to various market centers in the United States, see table 1-2.

Terrain and Soil—As previously noted, the timbered area lies between 6,500 and 7,500 feet elevation, with three-quarters or more of the lodgepole pine acreage on slopes of less than 45 percent. Soils are clay loam with very few rocks. Grassland borders the timber along lower edges (fig. 3-4).

Annual Precipitation and Duration of Snow-free Season—Annual precipitation totals about 20 inches, with 3 feet of snow on the ground common in winter. The snow-free season is generally from June 15 to November 15.

General Character of the Timber—Slopes timbered with lodgepole pine (mixed with alpine fir and containing extensive stringers of aspen) are in a band a couple of miles wide just east of the delineated western border of the area (fig. 3-3). The lodgepole pine is mostly in uneven-aged stands, with older trees up to 12 inches in d.b.h. intermingled with pole-size timber (fig. 3-5). Stands are not very dense. Fire has been absent for the past century, so mature stands range in age from 80 to 120 years.

Significant numbers of trees have been killed by mountain pine beetle, and dwarf mistletoe is generally present. Severe spiral grain is evident in some dead wood (fig. 3-6), but none was observed in a sampled pair of trees 3½ to 4 inches in d.b.h.

Except for some sanitation cuts, no significant harvests have been made, and none are in an advanced stage of planning.

Data on Sample Trees—A pair of adjacent 3½- to 4-inch codominants were destructively sampled at 6,500 feet close to Brockman Road in the center of the western edge of the delineated area (fig. 3-7). Some pertinent tree characteristics follow. These tabulated data should not be interpreted as statistically representative of all trees.

See appendix for an explanation of tree selection and procedures for evaluation of mechanical properties in compression parallel to the grain at 10 percent moisture content.

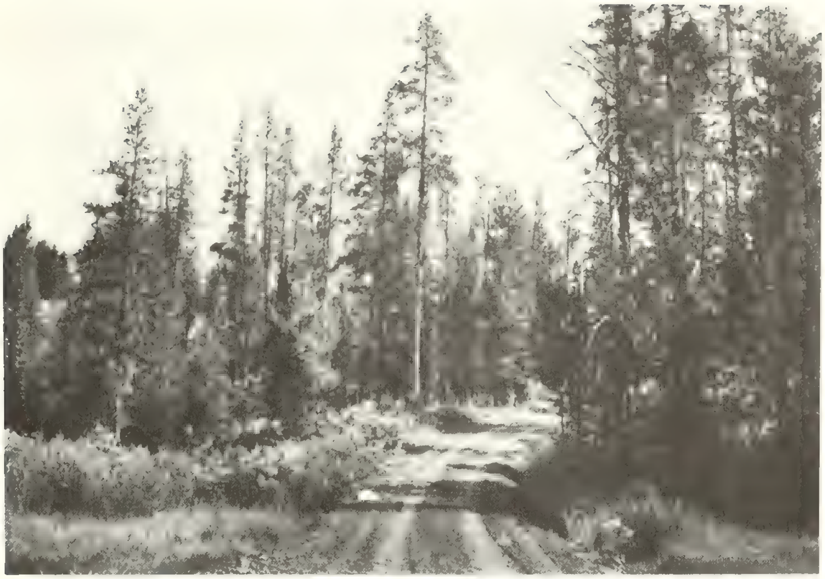

Figure 3-5—Uneven-aged lodgepole pine in the Brockman Road area of the Caribou National Forest; stocking is not dense, dwarf mistletoe is widespread, and mortality from bark beetles is significant.

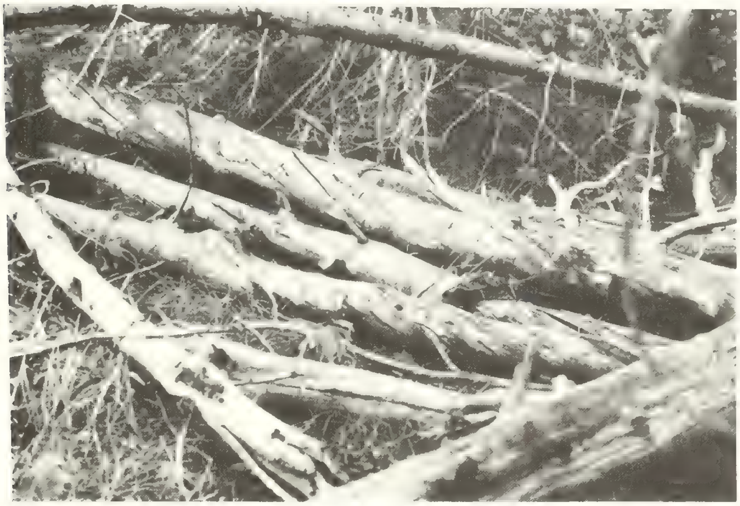

Figure 3-6—Spiral grain in lodgepole pine dead wood adjacent to Brockman Road in the Caribou National Forest.

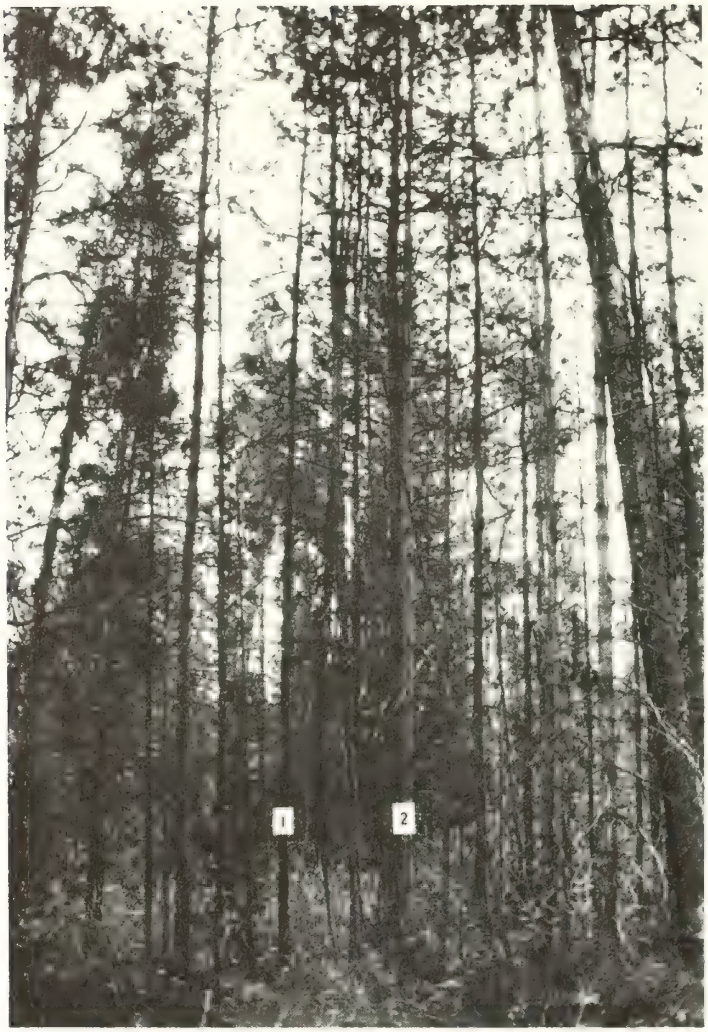

Figure 3-7—Pair of codominant lodgepole pines 3½ to 4 inches in d.b.h. sampled just west of Brockman Road in the central portion of the western edge of the Caribou National Forest area delineated in figure 3-3.

Characteristic	Tree number 1	Tree number 2
D.b.h. (outside bark), inches	4.00	3.75
Tree height above 6-inch high stump, feet	37.5	41.2
Crown ratio, percent	50.7	42.3
Cone serotiny	open	open
Tree age years (number of annual growth rings)		
Stump height	34	37
20 percent of tree height	26	30
Base of live crown	20	19
Diameter inside bark, inches		
Stump height	4.28	3.87
20 percent of tree height	3.59	3.39
Base of live crown	3.08	2.72
Height from stump top to base of crown, inches	222	285
Stem taper inside bark, inches/100 inches		
Below crown	0.54	0.40
Within crown	1.35	1.30
Rings/inch, average for section		
Stump height	16	19
Base of live crown	13	14
Properties of stemwood at 20 percent height		
Moisture content, percent ovendry weight	102.6	123.0
Specific gravity, ovendry weight and green volume	0.385	0.359
Rings/inch in first $1\frac{1}{4}$ inches radius	13	17
Maximum crushing strength, lb f/in^2	5,930	5,360
Proportional limit, lb f/in^2	4,260	3,710
Modulus of elasticity, lb f/in^2	1,160,000	1,220,000
Compression wood evident?	none	none
Spiral grain angle at surface, degrees	0	1
Bark thickness (single), inch	0.10	0.08
Pith eccentricity, inch	0.4	0.3

Inventory Data—Inventory data for the 2,500 acres of lodgepole pine timber type are incomplete. Based on estimates of knowledgeable managers concerned with the area, however, the following tabulation approximates the diameter distribution in a couple of typical compartments:

D.b.h. class	Compartment #190	Compartment #191
Inches	*- - Number of live stems per acre - -*	
1	1,358	1,744
2	50	123
3	35	23
4	13	31
5	56	44
6	37	31
7	42	53
8	24	54
9	37	33
10	22	16
11	10	13
12	14	7
13	6	6
14	6	3
15	6	2
16	3	1
17	0	1
17+	9	2
Total	1,728	2,187

Cubic Yield Potential and Height Growth—Data are not well documented, but the managers estimate that lodgepole pine in the area is currently growing at the rate of 40 to 50 ft^3 of stemwood per acre per year; for managed stands the potential is estimated at 80 ft^3 per acre per year. Fifty-year height growth in managed stands is estimated to be about 55 feet.

Management Objectives for the Area and Constraints—Accomplishment of economically viable, phased, small-scale, clearcut harvests done in a manner to favor natural regeneration into vigorous, controlled-density stands, while enhancing stand diversity, wildlife habitat, and long-term watershed values is the major management objective.

The primary obstacle to forestry practices for accomplishment of the objective is lack of markets for small-diameter lodgepole pine.

Other Lodgepole Pine Available in the Area From Public Lands—In addition to the 2,500 acres of lodgepole pine type timber in the Brockman Road area, the Caribou National Forest probably has another 20,000 acres of similar timber in which existing area mills have little interest.

Forest Products Industry in the Vicinity—There are no large forest industries in the immediate area. Major timber consumers in the region include a large sawmill in Rexburg that manufactures random-length dimension lumber (mostly from species other than lodgepole pine) and a large stud mill in St. Anthony that does use lodgepole pine. Another large mill that manufactures lodgepole pine studs is located in Afton, WY.

Population in the Vicinity—Bonneville County had a total population of 74,775 in 1985; the county seat of Idaho Falls has a population of 43,433 (1985) within the town limits. In 1986 the per-capita income in the Idaho Falls trade area was $9,056; in the entire county, annual per-capita income in 1984 was $10,884. Of those in the workforce, 4.2 percent were unemployed during 1985 in Bonneville County.

Caribou County, with a 1980 population of 8,695, contains the nearest railhead at Soda Springs (population 4,051)—the county seat. In 1984 the annual per-capita income in Caribou County was $9,612, and 7.9 percent of those in the workforce were unemployed during 1985.

CHALLIS NATIONAL FOREST

Area Name and Location—The Cape Horn area (figs. 3-8, 3-9, and 3-10), which lies at an elevation of 6,700 to 7,400 feet at latitude 44°22' and longitude 115°05', is in the Yankee Fork Ranger District of the Challis National Forest. The Ranger Station is in Clayton, ID.

The gross area of about 3,400 acres includes about 2,750 acres of lodgepole pine timber type and falls entirely within Custer County, ID; Challis is the county seat. The area lies just east of the Cape Horn Forest Service Guard Station (fig. 3-9), immediately south of the Frank Church-River of No Return Wilderness. From Stanley, ID, the area is 14 air miles northwest on a heading of 330°.

Maps of the Area—USGS quadrangle 7$^1/_2$' maps needed to depict the area are: Langer Peak and Elk Meadow.

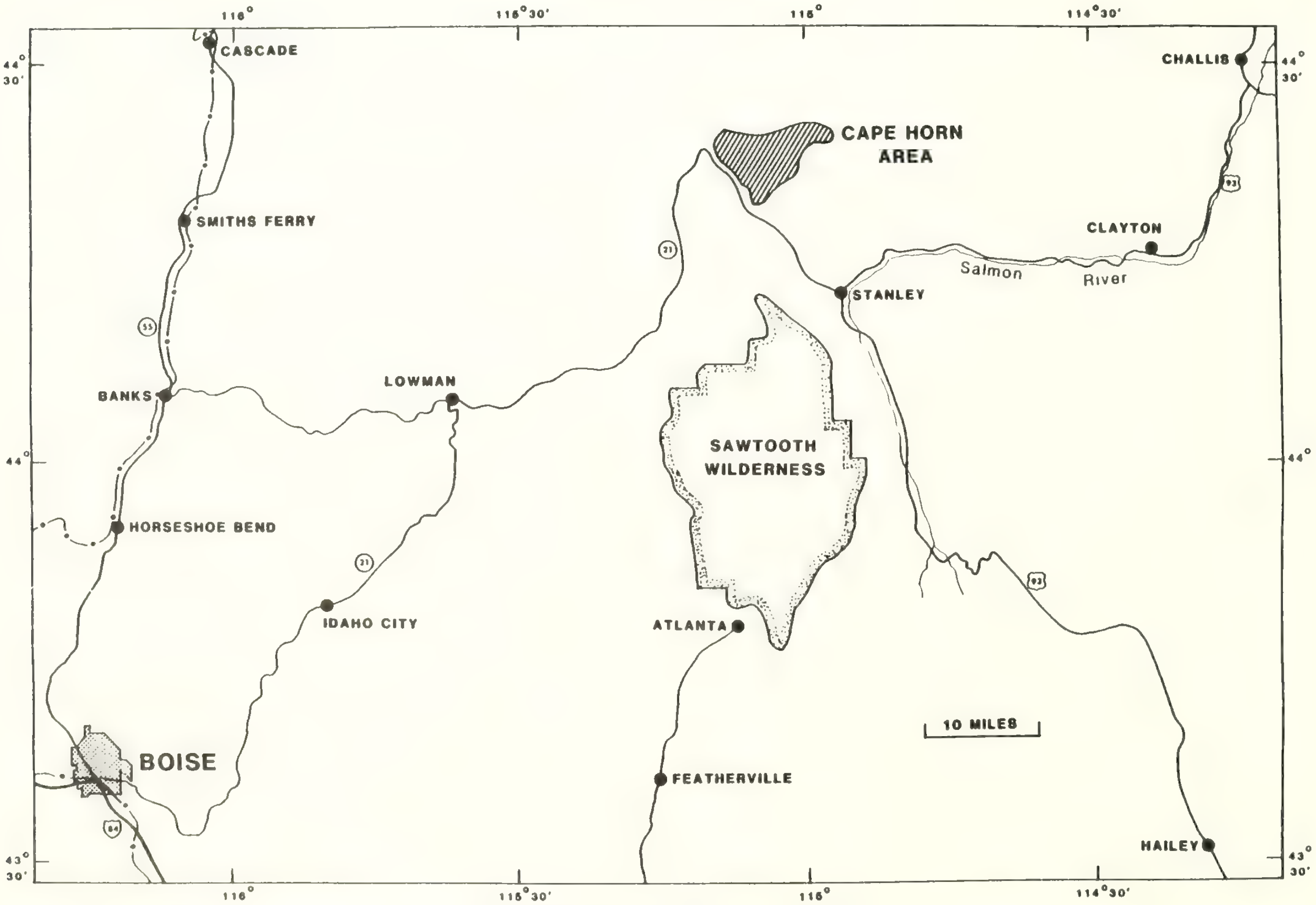

Figure 3-8—Vicinity map for the Cape Horn area of the Challis National Forest in Idaho.

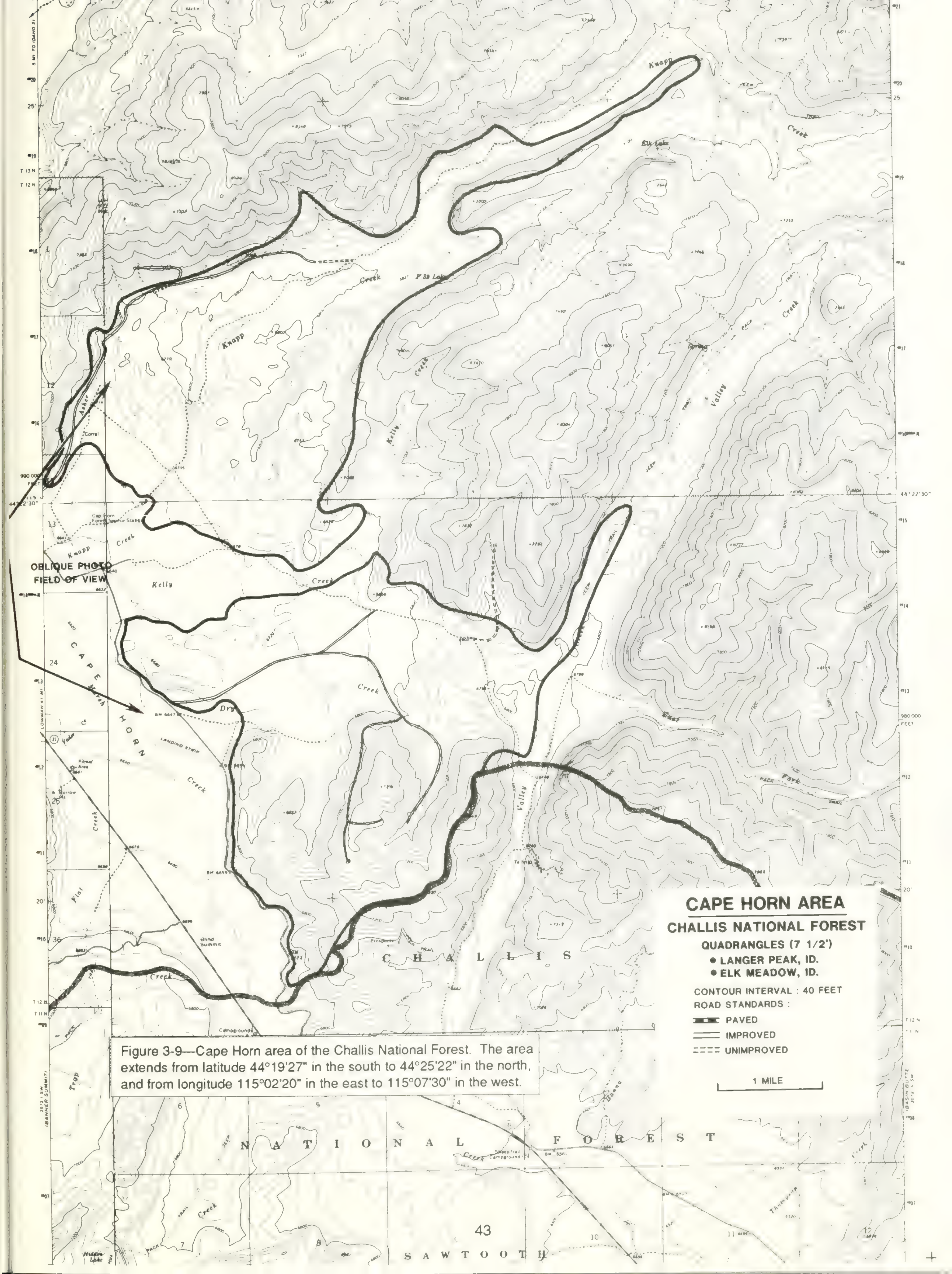

Figure 3-9—Cape Horn area of the Challis National Forest. The area extends from latitude 44°19'27" in the south to 44°25'22" in the north, and from longitude 115°02'20" in the east to 115°07'30" in the west.

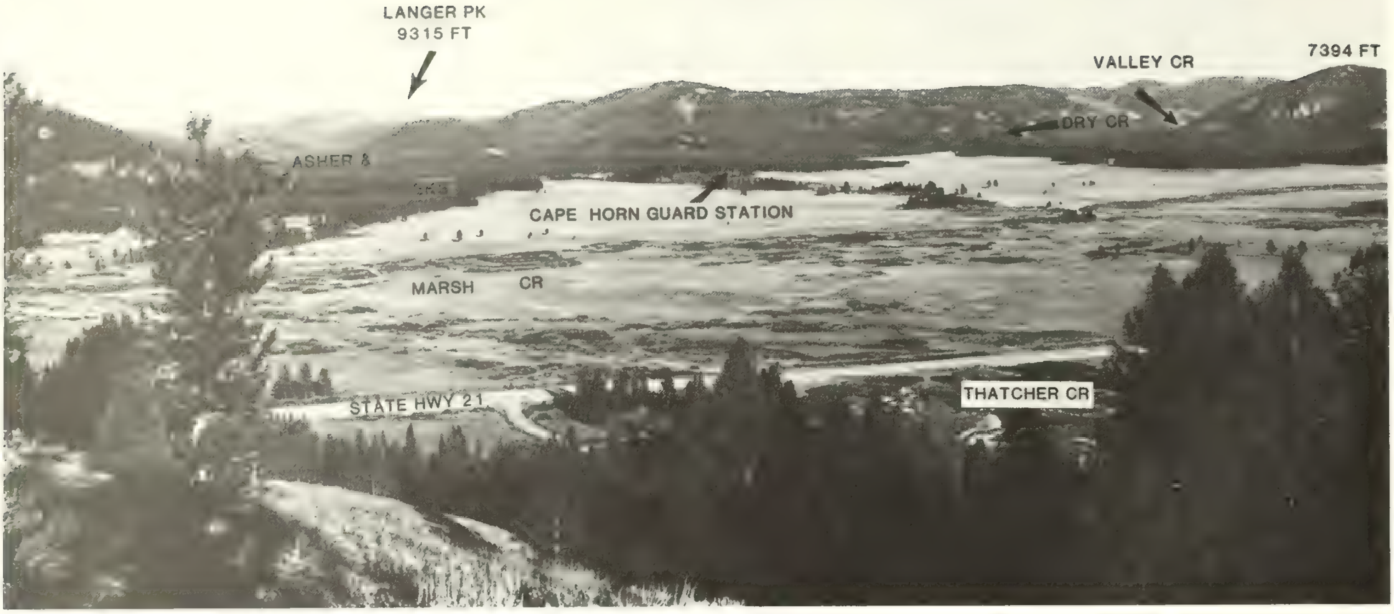

Figure 3-10—Oblique view of the Cape Horn area of the Challis National Forest looking east-northeast from near the Thatcher Creek Campground. The straight-line distance from State Highway No. 21 in the foreground to the Cape Horn Guard Station in midview is about 1¼ miles.

Access—From Stanley, it is 21 miles northwest via State Highway No. 21 to the turnoff to the Cape Horn Guard Station, and then about 2 miles east to the Station (figs. 3-8 and 3-9), from whence improved and unimproved roads give access to Asher Creek, Knapp Creek, and Dry Creek.

The nearest railhead is the town of Banks on a Union Pacific spur track that roughly parallels State Highway No. 55 between Boise and McCall. From the Cape Horn Guard Station it is about 70 miles to Banks via paved road to Lowman and gravel road from Lowman to Banks (fig. 3-8). Somewhat more distant—about 120 road miles—is the railhead at Boise. Snow intermittently closes roads to both Banks and Boise.

For highway distances from Boise to various market centers in the United States, see table 1-2.

Terrain and Soil—As previously noted, the lodgepole pine timber lies between 6,700 and 7,400 feet and is on level to gently sloping ground interspersed with meadows (fig. 3-10). Soils are decomposed granite. There are no special obstacles to harvesting, except deep snow and extreme cold in winter.

Annual Precipitation and Duration of Snow-free Season—Annual precipitation is about 30 inches, mostly falling as snow. The snow-free season generally extends from mid-June to the end of October. Winter temperatures may be as low as –50 °F.

General Character of the Timber—Lodgepole pine in the area grows on flats interspersed with meadows; these flats are evidently frost pockets that deter growth of other conifers. Stands are uneven aged, not very dense, and infested with dwarf mistletoe. Trees tend to be limby. D.b.h. ranges from 1 inch to a maximum of about 12 inches, but most are in the range from 4 to 7 inches (figs. 3-11 and 3-12).

At present, mortality caused by mountain pine bark beetles is not evident, nor is damage from porcupines. Trees are not excessively cankered.

Past harvesting activity has been sporadic and minor. The road network through the area was built to gain access to more valuable timber at higher elevations. Current activity is limited to small-scale post and pole harvests for local use.

Data on Sample Trees—A pair of adjacent 3½- to 4-inch codominants were destructively sampled at 6,800 feet from gently sloping terrain between Valley Creek and Dry Creek (fig. 3-12). Some pertinent tree characteristics follow. These tabulated data should not be interpreted as statistically representative of all trees.

See appendix for an explanation of tree selection and procedures for evaluation of mechanical properties in compression parallel to the grain at 10 percent moisture content.

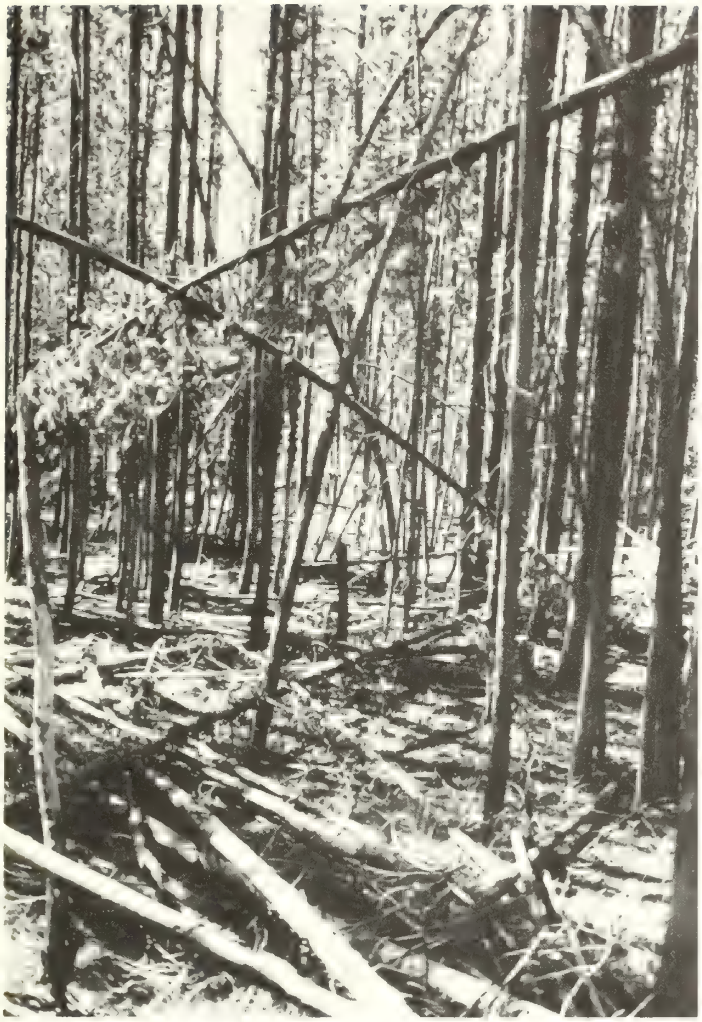

Figure 3-11—Stagnated, deteriorating, small-pole stand along Asher Creek in the Cape Horn area of the Challis National Forest.

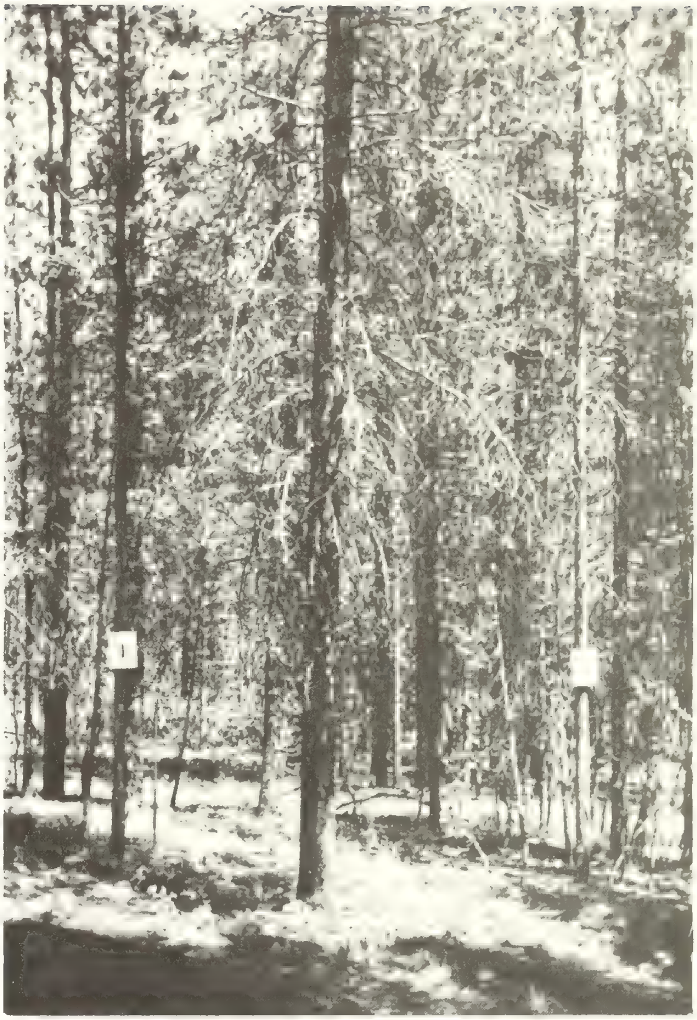

Figure 3-12—Pair of codominant trees 3½ to 4 inches in d.b.h. sampled between Valley Creek and Dry Creek in the Cape Horn area of the Challis National Forest.

Characteristic	Tree number 1	Tree number 2
D.b.h. (outside bark), inches	3.63	3.78
Tree height above 6-inch high stump, feet	26.0	36.7
Crown ratio, percent	65.4	53.2
Cone serotiny	open	open
Tree age years (number of annual growth rings)		
Stump height	53	62
20 percent of tree height	41	41
Base of live crown	32	25
Diameter inside bark, inches		
Stump height	3.63	4.01
20 percent of tree height	3.40	3.35
Base of live crown	3.15	2.68
Height from stump top to base of live crown, inches	108	206
Stem taper inside bark, inches/ 100 inches		
Below crown	0.44	0.65
Within crown	1.54	1.15
Rings/inch, average for section		
Stump height	29	31
Base of live crown	20	19
Properties of stemwood at 20 percent height		
Moisture content, percent ovendry weight	135.1	117.6
Specific gravity, ovendry weight and green volume	0.385	0.415
Rings/inch in first $1^1/_4$ inches radius	19	24
Maximum crushing strength, lb f/in²	4,410	5,550
Proportional limit, lb f/in²	2,280	3,720
Modulus of elasticity, lb f/in²	640,000	970,000
Compression wood evident?	slight	slight
Spiral grain angle at surface, degrees	1	2
Bark thickness (single), inch	0.11	0.14
Pith eccentricity, inch	0.2	0.1

Inventory Data—Inventory data for the 2,750 acres of lodgepole pine timber type are incomplete. Based on estimates of knowledgeable managers concerned with the area, however, the following tabulation approximates the diameter distribution of a typical acre:

D.b.h. class	Number of live stems per acre
Inches	
<2.9	30
3.0-3.9	103
4.0-4.9	130
5.0-5.9	150
6.0-6.9	120
7.0-7.9	80
8.0-8.9	20
9.0-9.9	15
10.0+	10
Total	658

Cubic Yield Potential and Height Growth—Although data are not well documented, managers estimate that the current lodgepole pine forests in the area are growing about 20 ft³ per year; the potential is estimated at 30 ft³ per year. Fifty-year height growth in managed stands is estimated at 40 to 50 feet.

Management Objectives for the Area and Constraints—It is the objective of managers of the area to improve timber quality and growth rate through harvest and regeneration into vigorous managed stands while enhancing wildlife habitat and watershed values. Also, visual quality of the timbersheds must be protected. The major deterrent to accomplishing this objective is lack of markets for small lodgepole pine timber.

Other Lodgepole Pine Available in the Area From Public Lands—In the immediate area (west across State Highway No. 21), the Challis National Forest has another 3,000 to 4,000 acres of similar lodgepole pine timber.

Farther west, in the Landmark-Bear Valley country of central Idaho, the Lowman Ranger District of the Boise National Forest administers more than 10,000 additional acres of this timber type.

Forest Products Industry in the Vicinity—There are no large forest industries immediately adjacent to the area. More than 100 miles distant to the southwest and northwest, however, there are large sawmills at railheads in New Meadows, Cascade, Horseshoe Bend, and Emmett. In Emmett there is also a plywood plant.

Population in the Vicinity—Custer County has a total population (1987) of 5,000; 1,200 reside in the county seat of Challis and 147 in the town of Stanley which—as noted previously—is only 21 miles from the area. In 1984, annual per-capita income in Custer County was $7,890. During 1985, 5.6 percent of those in the workforce were unemployed.

The railhead city of Boise (population 110,000) is in Ada County, which in 1986 had a total population of 195,200 and average per-capita income of $10,841. In 1986, 4.2 percent of those in the Ada County workforce were unemployed.

NEZ PERCE NATIONAL FOREST

Area Name and Location—The Kirks Fork area (figs. 3-13, 3-14, and 3-15), which lies at an elevation of 4,300 to 6,300 feet at latitude 45°51' and longitude 115°21', is in the Elk City Ranger District of the Nez Perce National Forest; the Ranger Station is in Elk City.

The gross area of about 5,040 acres includes about 4,300 acres of lodgepole pine timber type and falls entirely within Idaho County; Grangeville is the county seat. The area is immediately east of Elk City; from Grangeville the area is 40 air miles east-southeast on a heading of 102°.

Maps of the Area—USGS quadrangle $7^1/_2$' maps needed to depict the area are: Elk City and Black Hawk Mountain.

Access—From Elk City, a gravel road extends 4 miles to the northwest corner of the area but does not penetrate it; also, two gravel roads give access to the southwest and south perimeter of the area (fig. 3-14). Paved (but narrow) State Highways No. 14 and No. 13 run 64 miles from Elk

City down a gentle grade along the South Fork of the Clearwater River to the railhead at Kooskia, where No. 13 joins U.S. Highway No. 12 leading to the Snake River port of Lewiston, ID—60 highway miles farther west.

The nearest railhead is Grangeville, also reached via State Highway No. 14 down the South Fork of the Clearwater River to a junction 49 miles from Elk City from whence it traverses a steep climb 5 miles west to Grangeville.

For highway distances from Grangeville to major market centers in the United States, see table 1-2.

Terrain and Soil—As previously noted, the area lies between 4,300 and 6,300 feet elevation, with about two-thirds of the acreage having slopes of less than 45 percent. Soils are decomposed granite overlayed by 6 to 12 inches of volcanic ash. There are no special obstacles to harvesting.

Annual Precipitation and Duration of Snow-free Season—Annual precipitation totals 36 to 40 inches, about half falling as snow. The snow-free season usually extends from June 1 through mid-October. Midwinter temperatures generally fall to –25 °F for a few days.

General Character of the Timber—Trees in the northwest quarter are mostly from 4 to 11 inches in d.b.h., 50+ feet tall, and about 60 years old (figs. 3-16 and 3-17). There is little down timber in this quarter and ground cover indicates a good site for lodgepole pine. No mortality from mountain pine beetle is evident, and porcupine damage is absent. Little dwarf mistletoe is present. A few of the stems have forks, a few have cankers, and there is a tendency to retain small dead limbs—but in general the lodgepole appears to be of good quality.

The southwest half is composed of dense stands of small timber lacking sufficient vigor to warrant thinning. The northeast portion is a mosaic of meadows, open-grown stands, and dense stands.

The last major fire in the area was in 1919. There has been no harvesting activity in the area, and none is currently planned.

Data on Sample Trees—A pair of adjacent codominants $3^{1}/_{2}$ to 4 inches in d.b.h. were destructively sampled from a level site at 4,600 feet elevation in the northwest corner of the area (fig. 3-17). Some pertinent tree characteristics follow. These tabulated data should not be interpreted as statistically representative of all trees.

See appendix for an explanation of tree selection and procedures for evaluation of mechanical properties parallel to the grain at 10 percent moisture content.

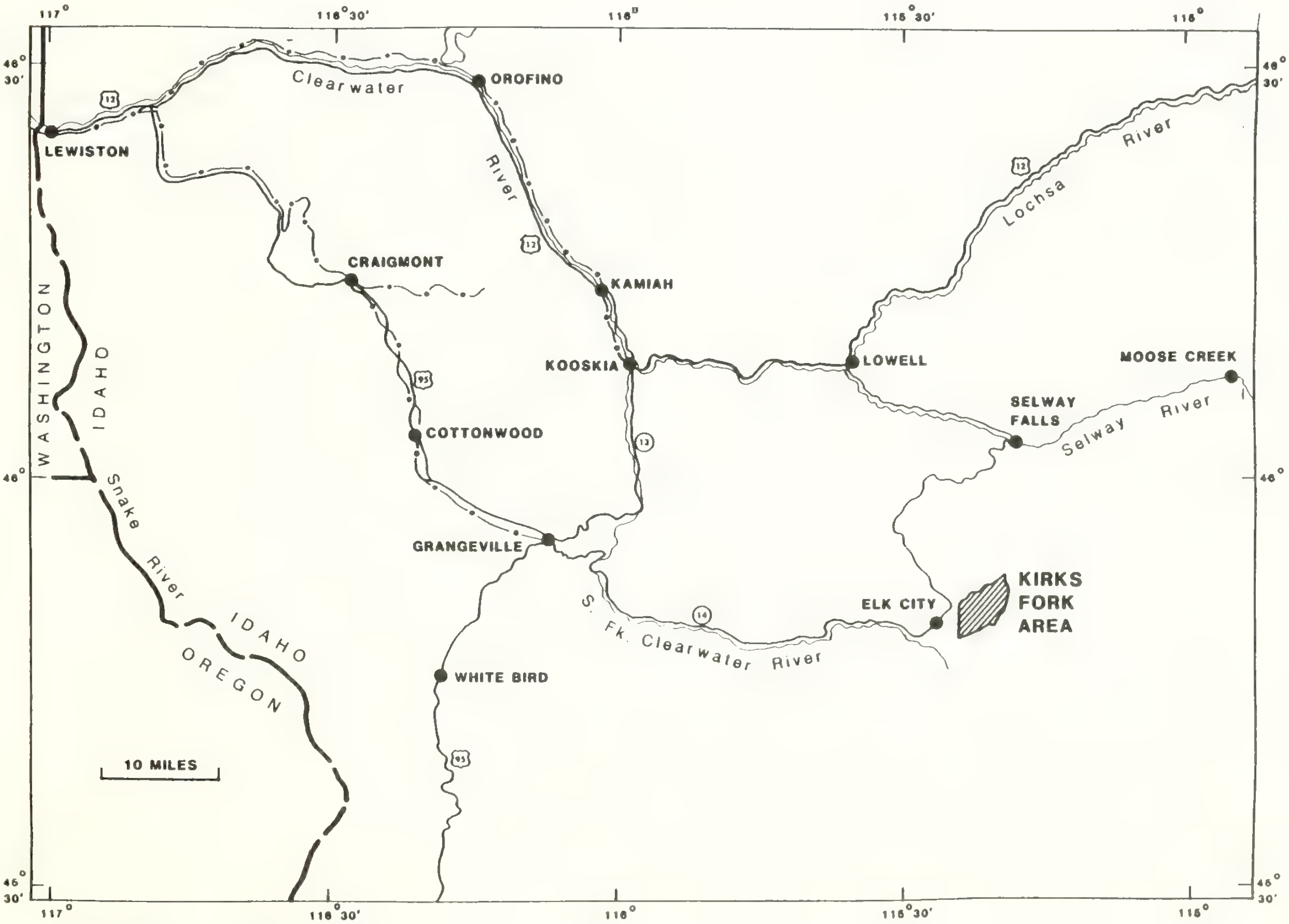

Figure 3-13—Vicinity map for the Kirks Fork area of the Nez Perce National Forest in Idaho.

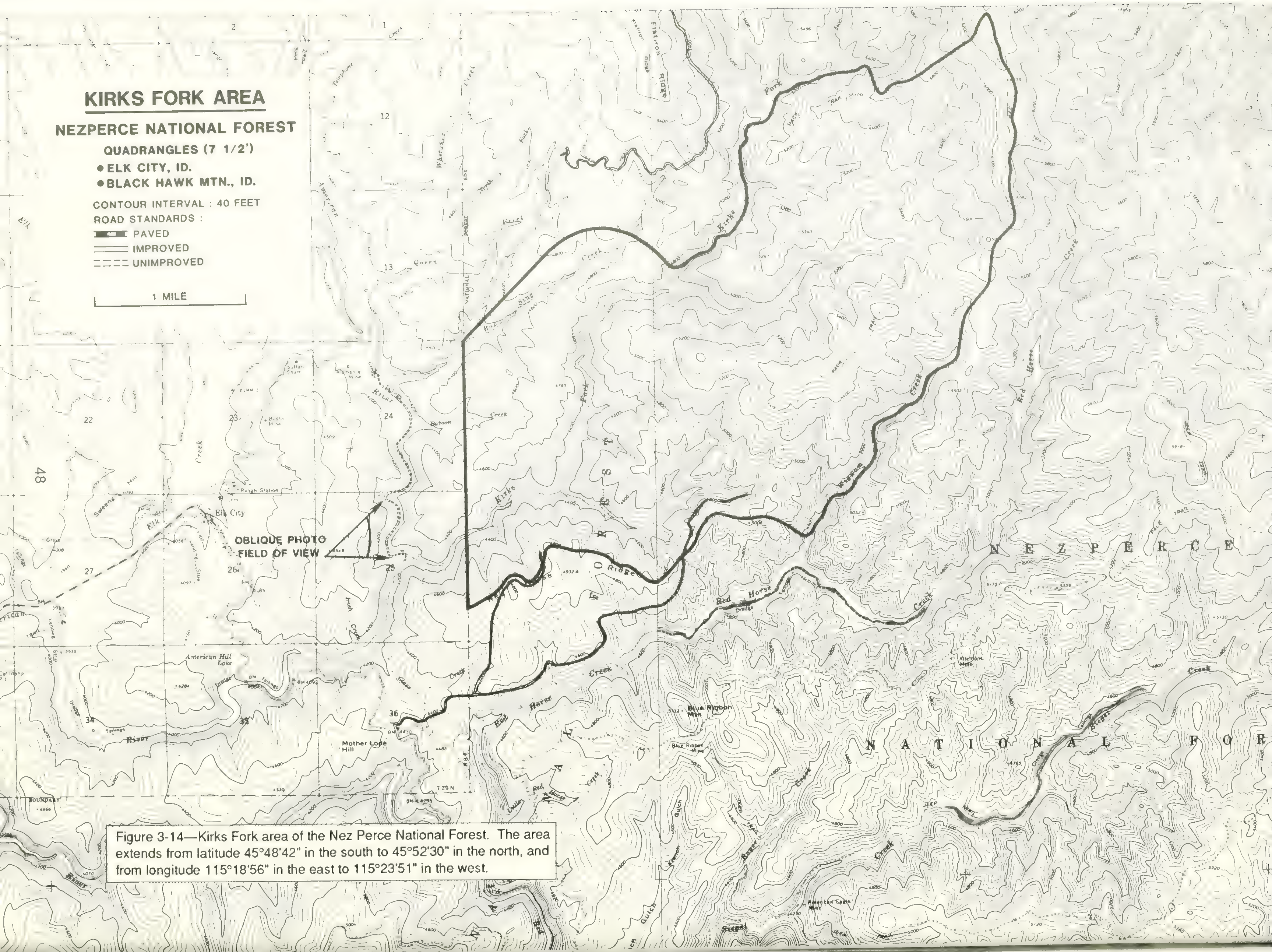

Figure 3-14—Kirks Fork area of the Nez Perce National Forest. The area extends from latitude 45°48'42" in the south to 45°52'30" in the north, and from longitude 115°18'56" in the east to 115°23'51" in the west.

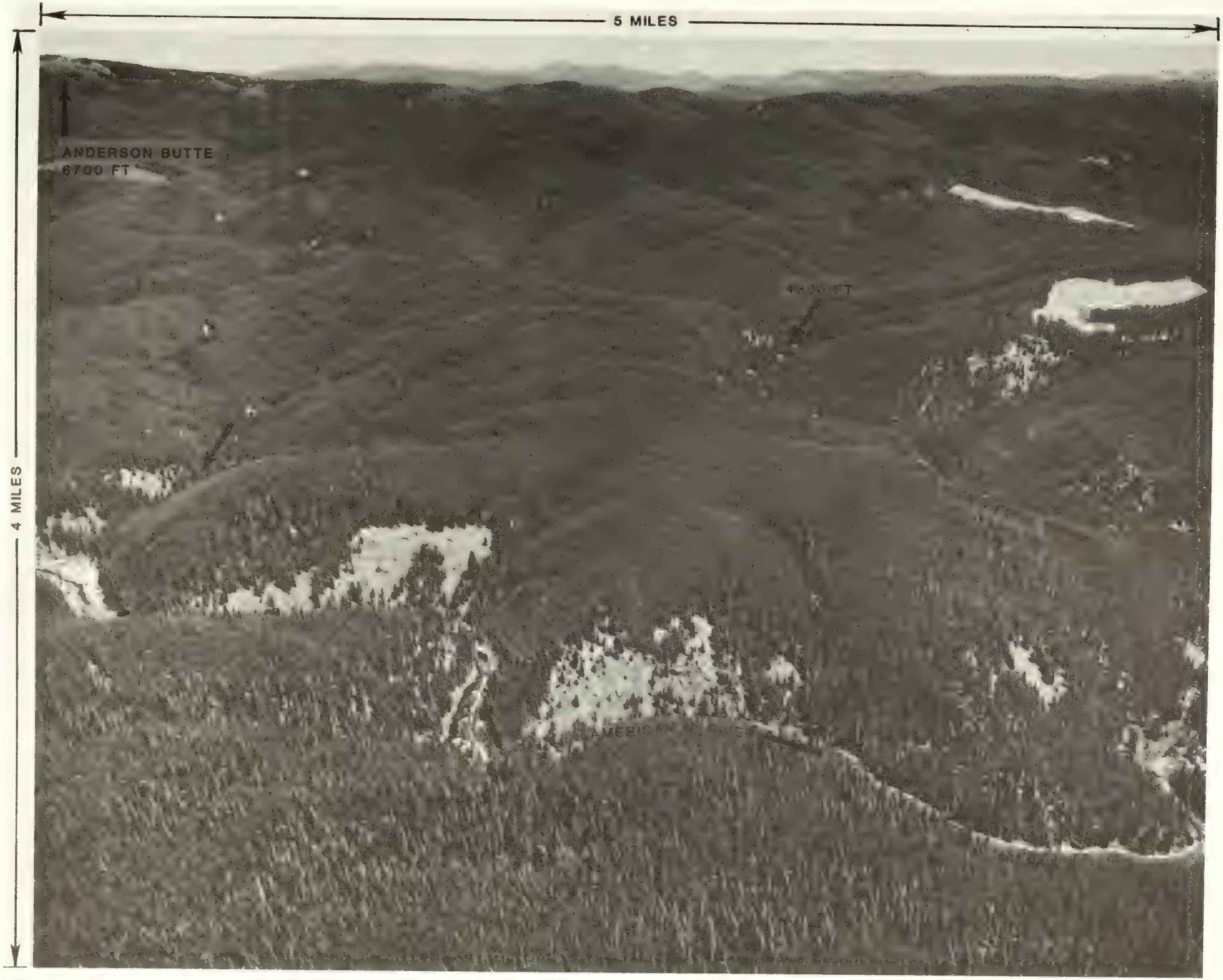

Figure 3-15—Oblique view of Kirks Fork area of the Nez Perce National Forest looking northeast across Anderson River up Kirks Fork and Baboon Creek; see figure 3-14 for camera viewpoint and field. Width of the background is about 5 miles; from the foreground to the timbered ridge on the left skyline is about 4 miles.

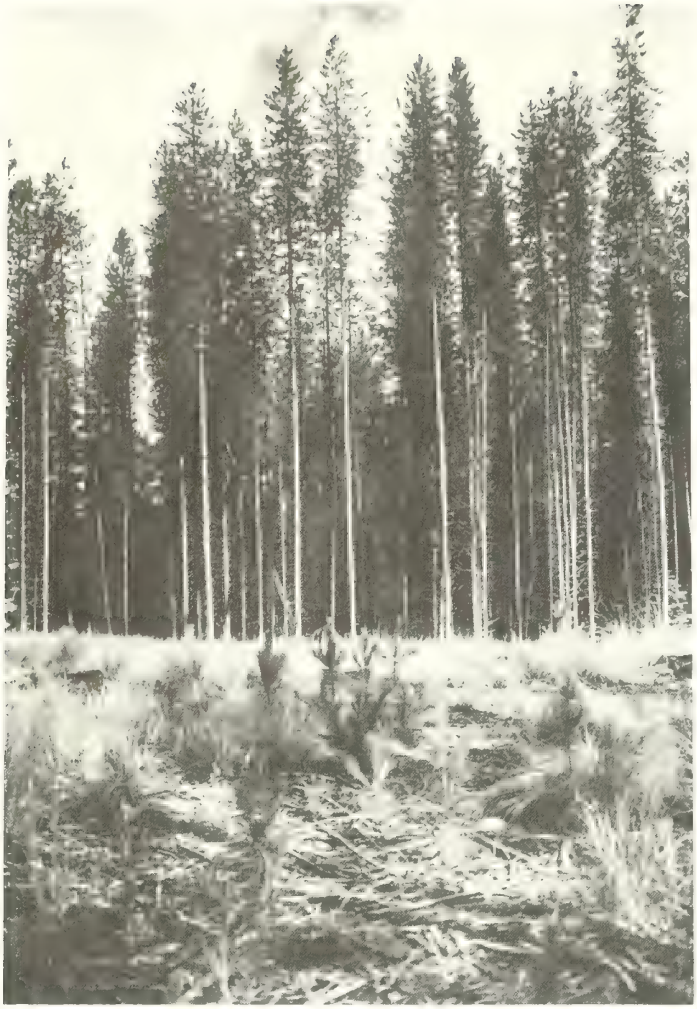

Figure 3-16—Tall, straight lodgepole pines 4 to 11 inches in d.b.h. and about 60 years old in northwest corner of Kirks Fork area of the Nez Perce National Forest. In the foreground, thrifty lodgepole natural regeneration is visible in a beargrass opening resulting from a small clearcut.

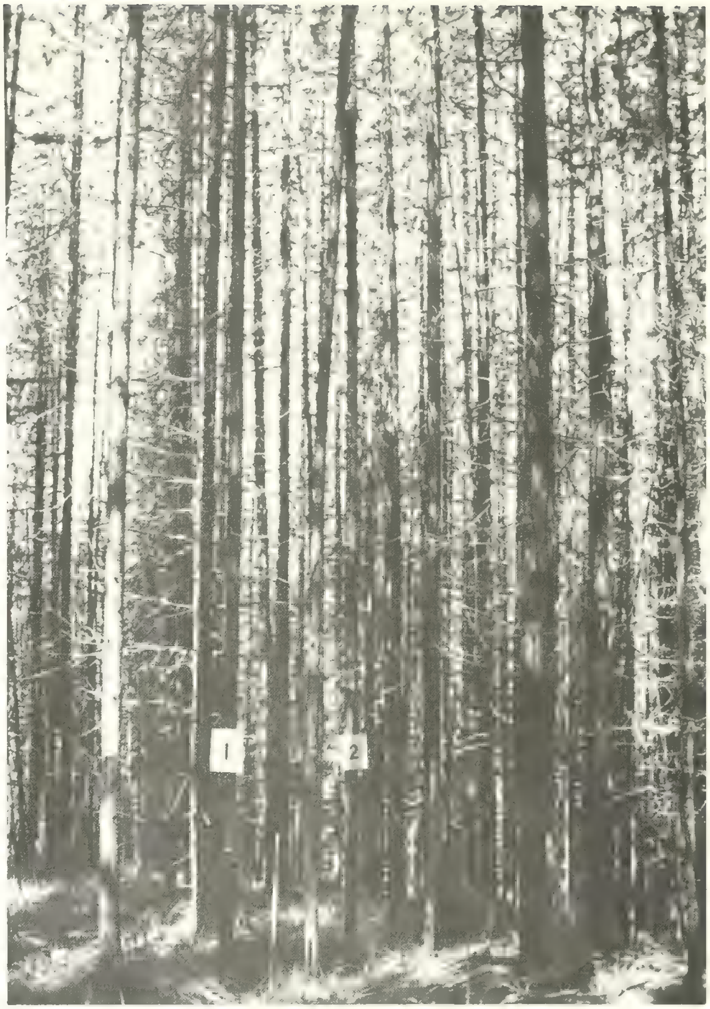

Figure 3-17—Pair of codominant trees 3½ to 4 inches in d.b.h. sampled at 4,600 feet in the northwest corner of the Kirks Fork area of the Nez Perce National Forest.

Characteristic	Tree number 1	Tree number 2
D.b.h. (outside bark), inches	3.81	3.82
Tree height above 6-inch high stump, feet	52.0	54.5
Crown ratio, percent	43.3	32.7
Cone serotiny	closed	closed
Tree age years (number of annual growth rings)		
Stump height	61	61
20 percent of tree height	50	50
Base of live crown	34	30
Diameter inside bark, inches		
Stump height	3.65	3.98
20 percent of tree height	3.45	3.31
Base of live crown	2.52	2.01
Height from stump top to base of crown, inches	354	440
Stem taper inside bark, inches/ 100 inches		
Below crown	0.32	0.45
Within crown	0.93	0.94
Rings/inch, average for section		
Stump height	33	31
Base of live crown	27	30
Properties of stemwood at 20 percent height		
Moisture content, percent ovendry weight	74.6	92.0
Specific gravity, ovendry weight and green volume	0.452	0.450
Rings/inch in first 1¹/₄ inches radius	14	13
Ultimate compresssive strength, lb f/in²	5,370	6,100
Proportional limit, lb f/in²	3,980	5,120
Modulus of elasticity, lb f/in²	1,420,000	1,520,000
Compression wood evident?	none	none
Spiral grain angle at surface, degrees	2	3
Bark thickness (single), inch	0.13	0.11
Pith eccentricity, inch	0.1	0.1

Inventory Data—Inventory data on the area are incomplete. Based on estimates of knowledgeable managers concerned with the area, however, the following tabulation approximates diameter distribution on a typical acre:

D.b.h. class	Number of live stems per acre
Inches	
<2.9	68
3.0-4.9	79
5.0-6.9	76
7.0-8.9	100
9.0+	43
Total	366

Cubic Yield Potential and Height Growth—Although not well documented, it is estimated that the potential growth of lodgepole pine forests in the area is 40 to 50 ft³ per acre per year. Fifty-year height growth in a managed stand is estimated to be about 50 feet.

Management Objectives for the Area and Constraints—The southwest third of the area is managed primarily for big game winter range, but this does not preclude harvest activities. Timber production is the major objective on the balance of the area, together with protection of wildlife habitat and watershed values. For ecological reasons, road construction will be limited to one or two consecutive seasons per decade. The major obstacle to accomplishing management objectives is lack of markets for subsawlog-size lodgepole pine and the associated grand fir and Douglas-fir.

Other Lodgepole Pine Available in the Area From Public Lands—East and south of Elk City, on the adjacent Red River District of the Nez Perce National Forest, lies more than 100,000 additional acres of similar lodgepole pine timber type. Because of anadromous fish habitat on this district, however, harvest activities must be more carefully planned than on some other districts.

Forest Products Industry in the Vicinity—In Elk City there is a large sawmill cutting random-length dimension lumber, but this mill is designed for fairly large logs rather than small-diameter lodgepole pine. The railhead towns of Kooskia and Grangeville each have sizable sawmills cutting random-length dimension lumber from a variety of species, and there is a sawmill in Cottonwood that cuts primarily ponderosa pine. Lewiston has the largest integrated utilization complex in the extended area; it includes a kraft pulp mill and lies at the head of barge navigation on the Snake River.

Population in the Vicinity—In 1980 Idaho County had a total population of 14,769; 3,660 reside within the limits of the town of Grangeville. In 1983 the per-capita income in Idaho County was $8,456, with 11.8 percent of the workforce unemployed.

IDAHO PANHANDLE NATIONAL FORESTS

Area Name and Location—The Wampus, Goat, Blackburn, and Heller Creeks area (figs. 3-18, 3-19, and 3-20), which lies at an elevation of 4,700 to 7,300 feet at latitude 47°05' and longitude 115°13', is in the Avery Ranger District of the Idaho Panhandle National Forests (hereinafter referred to as Panhandle); the Ranger Station is in Avery.

The gross area of about 3,900 acres includes about 3,120 acres of lodgepole pine timber type and falls entirely within Shoshone County; Wallace is the county seat. The area is just north of the St. Joe River at its junction with Heller Creek; the Montana-Idaho line forms the northeast border of the area, which is centered on a line between Simmons Peak in the west and Binocular Peak in the east (figs. 3-19 and 3-20). From Avery the area is 30 air miles southeast on a heading of 115°, and from the Missoula airport it is 52 air miles west-northwest on a heading of 283°.

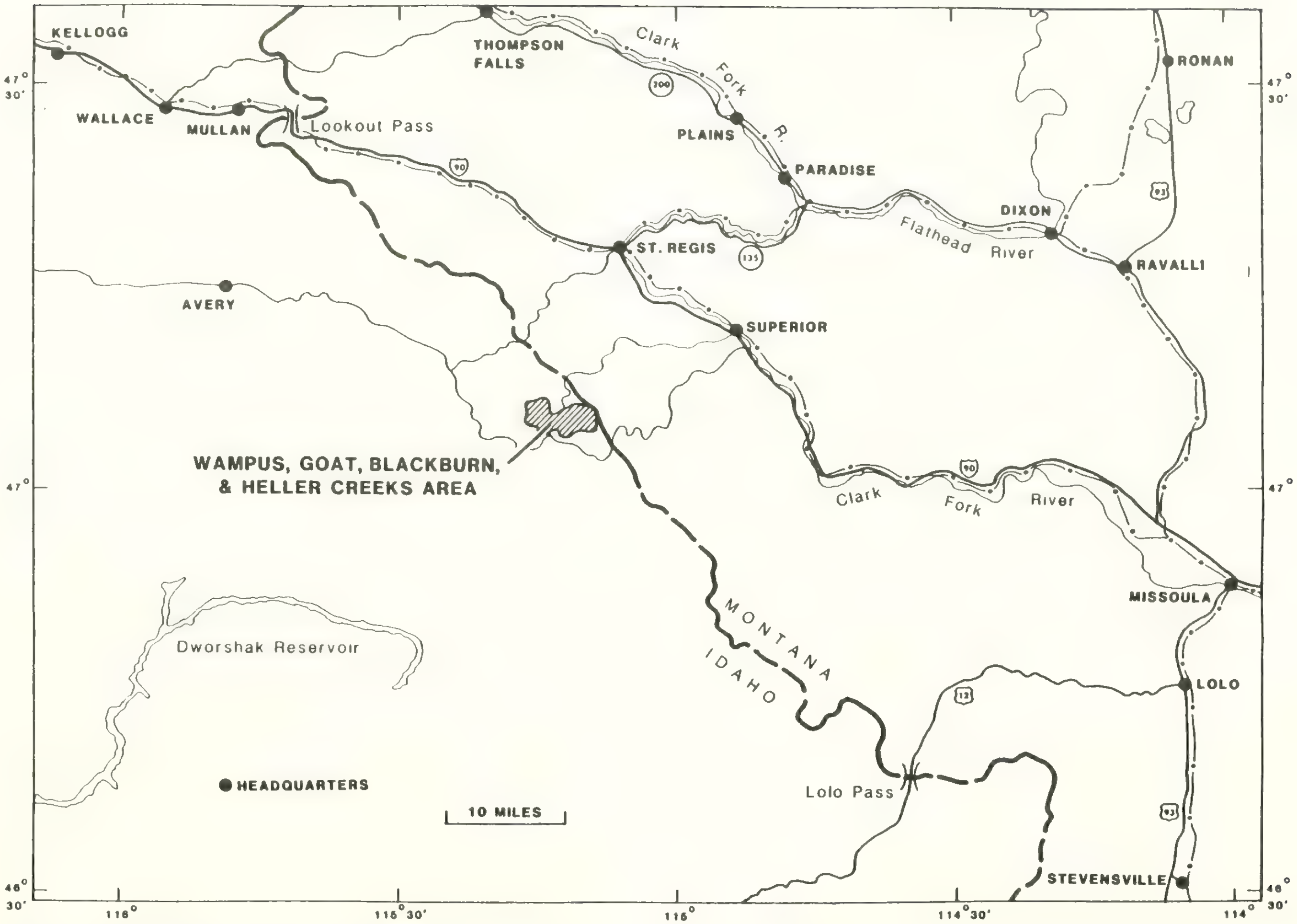

Figure 3-18—Vicinity map for the Wampus, Goat, Blackburn, and Heller Creeks area of the Idaho Panhandle National Forests in Idaho.

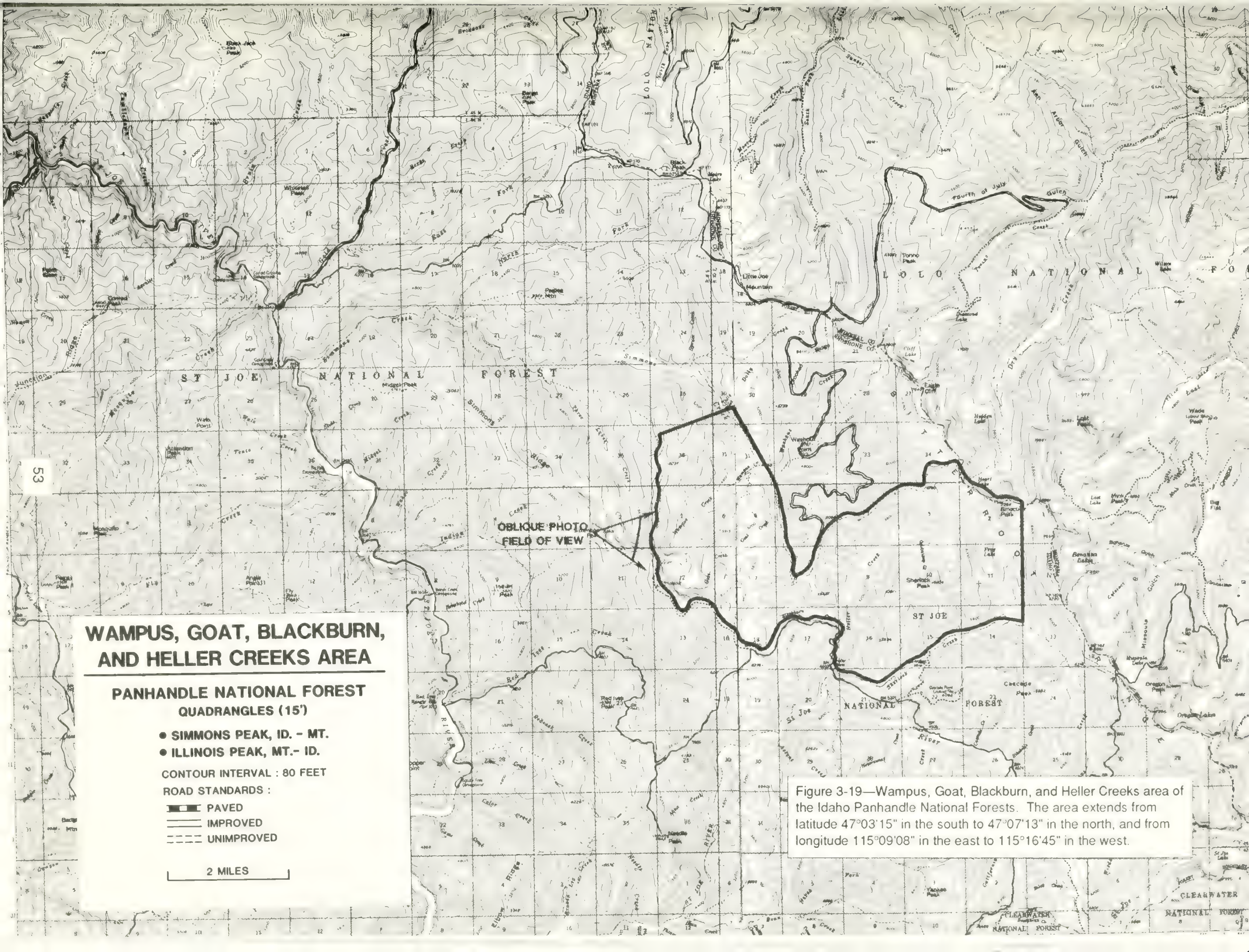

Figure 3-19—Wampus, Goat, Blackburn, and Heller Creeks area of the Idaho Panhandle National Forests. The area extends from latitude 47°03'15" in the south to 47°07'13" in the north, and from longitude 115°09'08" in the east to 115°16'45" in the west.

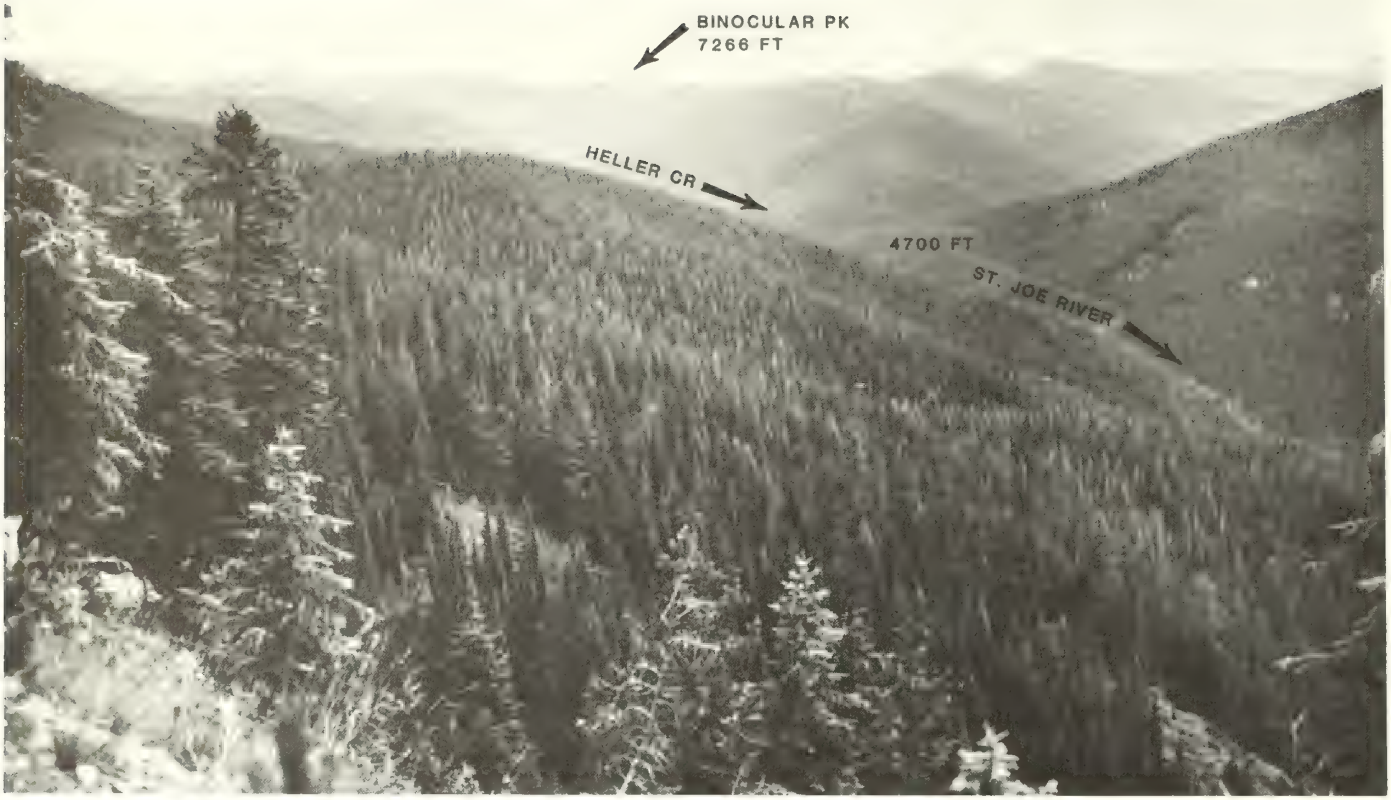

Figure 3-20—Oblique view of the Wampus, Goat, Blackburn, and Heller Creeks area of the Idaho Panhandle National Forests from Simmons Peak (6,700 feet) immediately west of the area delineated on figure 3-19. From camera viewpoint to Binocular Peak on the horizon is about 6½ miles.

Maps of the Area—USGS quadrangle 15' maps needed to depict the area are: Simmons Peak, ID-MT, and Illinois Peak, ID-MT.

Access—Easiest access to the area is from the railhead (Burlington Northern) town of St. Regis via a paved road running 29 miles southwest over a 5,813-foot pass at the Montana-Idaho border to where Gold Creek enters the St. Joe River (elevation 3,343 feet). This stream intersection can also be reached by gravel road up the St. Joe River from St. Maries and Avery. From where Gold Creek enters the St. Joe River, it is 10 miles via gravel road west up the St. Joe to Red Ives Ranger Station. From the station, an unimproved dirt road runs an additional 9 miles to the southwest border of the area (elevation 6,060 feet), where there is a branch road leading to Simmons Peak; the main road runs another 3 miles to where Heller Creek empties into the St. Joe River (elevation 4,693 feet). Improved roads also lead from the north-central edge of the area to St. Regis and to Superior (figs. 3-18 and 3-19).

For highway distances from St. Regis to various market centers in the United States, see table 1-2.

Terrain and Soil—The timbered area lies mostly between 4,700 and 6,500 feet, with nearly seven-eighths of the lodgepole pine acreage having slopes of more than 45 percent. Soils are weathered parent material overlayed with volcanic ash of variable depth. Steep slopes and difficult access are the primary obstacles to harvesting.

Annual Precipitation and Duration of Snow-free Season—Annual precipitation in the area totals 50 inches at lower elevations and 60 inches at upper, most of which falls as snow. The snow-free season generally extends from mid-July to mid-October.

General Character of the Timber—At 6,000 feet elevation the lodgepole pines are open grown, fairly short, tapered, and limby. At lower elevation near the creek bottoms, trees are taller, somewhat less limby, and stands have denser stocking (fig. 3-21). Near Heller Creek, where it empties into the St. Joe River, wind breakage of the lodgepole pine is significant; forked stems are prevalent, and many are broken at forks and cankers.

Most of the trees are 5 to 10 inches in d.b.h. and 60 to 75 years old (smaller-diameter trees may be only 45 years old). The largest trees measure about 20 inches in d.b.h. Breast-height growth of a 9.2-inch tree southeast of the Heller Creek campground (elevation 4,693 feet) averaged 11.5 rings per inch.

Several trees (9 to 11 inches in d.b.h.) growing at 3,700 feet near the Red Ives Station showed breast-height growth of 8 to 10 rings per inch, which is quite rapid for lodgepole pine in the intermountain region.

In general, however, tree quality within the delineated area is probably below average for all the areas studied. Subalpine fir and mountain hemlock are prevalent at higher elevations, and stringers of fir/hemlock extend into the lodgepole pine.

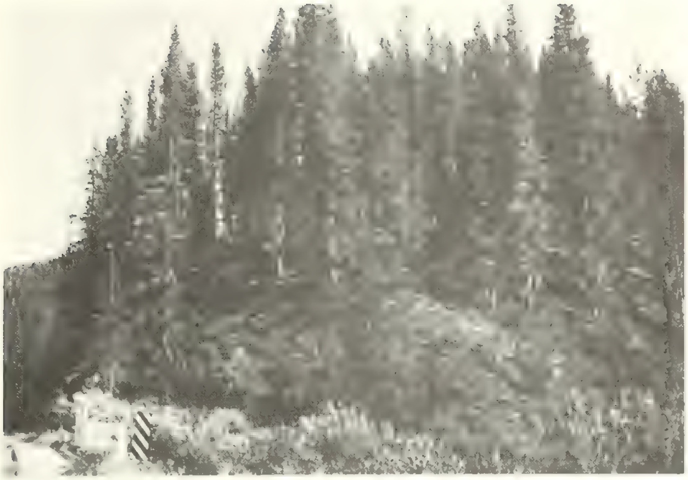

Figure 3-21—Lodgepole pine stand viewed looking northeast from junction of Heller and Sherlock Creeks (elevation 4,700 feet). Trees are mostly 5 to 11 inches in d.b.h.

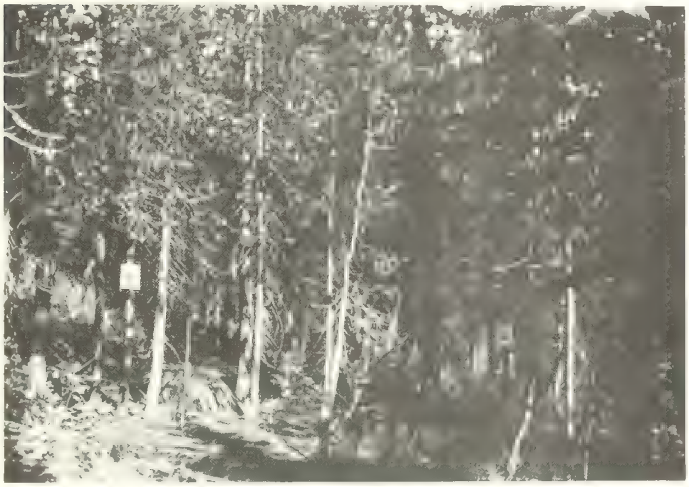

Figure 3-22—Pair of adjacent sample trees 3½ to 4 inches in d.b.h. in tall understory of lodgepole pine stand at 6,060 feet on level terrain just south of Blackburn Creek on the Idaho Panhandle National Forests.

No mortality from mountain pine beetles is evident, and porcupine damage is absent. Dwarf mistletoe is present in some stands, but is not considered a serious problem.

There has been no harvesting in the area, and none is planned for the immediate future. The last general fires to burn in the area were in 1889 and 1910.

Data on Sample Trees—A pair of adjacent 3½- to 4-inch trees from the tall understory of a stand at 6,060 feet on level terrain just south of Blackburn Creek were destructively sampled (fig. 3-22). Some pertinent tree characteristics follow. These tabulated data should not be interpreted as statistically representative of all trees.

See appendix for an explanation of tree selection and procedures for evaluation of mechanical properties in compression parallel to the grain at 10 percent moisture content.

Characteristic	Tree number 1	Tree number 2
D.b.h. (outside bark), inches	3.78	3.75
Tree height above 6-inch high stump, feet	26.0	31.0
Crown ratio, percent	55.1	68.3
Cone serotiny	open	open
Tree age years (number of annual growth rings)		
Stump height	45	45
20 percent of tree height	35	33
Base of live crown	27	27
Diameter inside bark, inches		
Stump height	3.83	3.88
20 percent of tree height	3.50	3.29
Base of live crown	2.90	2.95
Height from stump top to base of live crown, inches	140	118
Stem taper inside bark, inches/100 inches		
Below crown	0.65	0.79
Within crown	1.69	1.16
Rings/inch, average for section		
Stump height	23	23
Base of live crown	19	18
Properties of stemwood at 20 percent height		
Moisture content, percent ovendry weight	114.2	87.9
Specific gravity, ovendry weight and green volume	0.400	0.439
Rings/inch in first 1¼ inches radius	14	14
Ultimate compresssive strength, lb f/in^2	4,510	5,060
Proportional limit, lb f/in^2	2,720	1,830
Modulus of elasticity, lb f/in^2	640,000	1,020,000
Compression wood evident?	significant	significant
Spiral grain angle at surface, degrees	0	1
Bark thickness (single), inch	0.12	0.12
Pith eccentricity, inch	0.2	0.3

Inventory Data—Inventory data are incomplete. As noted previously, most of the stands have trees predominantly 5 to 10 inches in d.b.h., with stand density varying inversely with elevation. Based on estimation of knowledgeable managers concerned with the area, however, the following approximates diameter distribution in typical lodgepole pine stands at a medium elevation of about 5,200 feet:

D.b.h. class	Number of live stems per acre
Inches	
<2.9	100
3.0-4.9	300
5.0-6.9	385
7.0-8.9	116
9.0+	28
Total	929

Cubic Yield Potential and Height Growth—Although not well documented, it is estimated that such typical lodgepole pine stands in the area are growing about 136 ft^3 of wood per acre per year. Fifty-year height growth in managed stands is estimated at about 50 feet.

Management Objectives for the Area and Constraints—It is the objective of managers responsible for the area to accomplish phased harvests and to naturally regenerate with vigorous, young, controlled-density stands of lodgepole pine, while protecting wildlife habitat, esthetic, and watershed values. The major obstacles to accomplishment of the objective are lack of access, steep terrain, and lack of markets for small-diameter lodgepole pine and alpine fir of relatively low quality.

Other Lodgepole Pine Available in the Area From Public Lands—The Avery Ranger District has at least 60,000 acres of lodgepole pine timber type in addition to that within the delineated area. Acreage of similar timber in adjacent ranger districts was not explored.

Forest Products Industry in the Vicinity—There are no large forest industries immediately adjacent to the area. In Superior there is a large sawmill cutting random-length dimension lumber; in St. Regis there is one manufacturer of house logs. In Missoula, which is 72 miles from St. Regis, there are several large sawmills, a particleboard plant, and a kraft pulpmill.

Population in the Vicinity—In 1986 Shoshone County, ID, had a total population of 16,440; 1,786 people reside in the county seat of Wallace, and 2,500 in Kellogg. Annual per-capita income in the county is about $15,000; approximately 30 percent of the workforce was unemployed in 1986.

Adjacent Mineral County in Montana had a total population in 1984 of 3,700, with 1,054 residing in the county seat of Superior. St. Regis has perhaps half the population of Superior. Per-capita income in Mineral County averaged $9,638 in 1984; in 1986, 8.8 percent of those in the workforce were unemployed.

PAYETTE NATIONAL FOREST

Area Name and Location—The Stratton Creek area (figs. 3-23, 3-24, 3-25, and 3-26), which lies at an elevation of 5,800 to 7,700 feet at latitude 45°17' and longitude 115°44', is in the McCall Ranger District of the Payette National Forest; the Ranger Station is in McCall.

The gross area of about 7,800 acres is essentially all timbered with lodgepole pine (together with a little alpine fir). It lies entirely within Idaho County; Grangeville is the county seat. The area is centered around Stratton Creek; it is just northwest of the town of Warren immediately west of Warren Creek and north of the Warren Wagon Road. The center of the area is about 10 miles south of the Salmon River and 32 air miles northeast of McCall on a heading of 35°.

Map of the Area—The USGS metric quadrangle map (30 by 60 minutes) needed to depict the area is Warren, ID.

Access—From McCall a paved road runs northeast 30 miles over Secesh Summit (6,376 feet) to where the road branches to Burgdorf and to Warren; from this point a gravel road runs east 10 miles to Steamboat Summit (6,694 feet) at the southernmost perimeter of the area, and then drops another 3 miles to the Warren Creek Gaging Station (5,836 feet) and the airstrip and town of Warren. This gravel road is not plowed in winter; winter mail is delivered intermittently to Warren by airplane.

An unimproved dirt road runs from the Burgdorf-Warren intersection northwest to the Salmon River and downstream west to Riggins—a distance of about 45 miles.

The nearest railhead is Cascade, 20 miles south of McCall. There is also a railhead at Tamarack, 20 miles west of McCall. For highway distances from McCall to various market centers in the United States, see table 1-2.

Terrain and Soil—As previously noted, the timbered area lies between 5,800 and 7,700 feet elevation, with about half the acreage on slopes of less than 50 percent (figs. 3-25 and 3-26). The better sites are on relatively flat ground. Soils are sandy, of variable depth, and derived from granitics. Large stones or stone outcroppings are not evident, and there are no special terrain obstacles to harvesting. Considerable private land (mining claims) lies along Warren Creek to the east of the area (fig. 3-26).

Annual Precipitation and Duration of Snow-free Season—Annual precipitation totals 25 to 28 inches, most of which falls as snow. The snow-free season generally extends from about June 1 to late November.

General Character of the Timber—Much of the area was logged (high-graded) in the 1930's to provide fuel for the gold dredges in Warren. Because of these harvests, many of the current stands have dual age classes (fig. 3-27) in which the overstory measures 8 to 10 inches in d.b.h. and the understory is less than 3 inches in d.b.h. Along upper Stratton Creek the overstory is decadent with significant mortality evident.

Just west of Warren Creek there are uniform pole stands about 80 years of age (fig. 3-28).

About half the trees bear open cones, and half closed. Mortality from mountain pine beetle was heavy in the 1930's, but beetle mortality is not currently evident. Some stands have significant dwarf mistletoe infestation.

Except for very small-scale firewood and post and pole operations, no harvests are planned for the immediate future because of lack of markets.

Data on Sample Trees—A pair of adjacent 3½- to 4-inch codominants on gently sloping terrain (5,900 feet) just north of Stratton Creek and about one-fourth mile west of Warren Creek were destructively sampled (fig. 3-28). Some pertinent tree characteristics follow. These tabulated data should not be interpreted as statistically representing all trees.

See appendix for an explanation of tree selection and procedures for evaluation of mechanical properties in compression parallel to the grain at 10 percent moisture content.

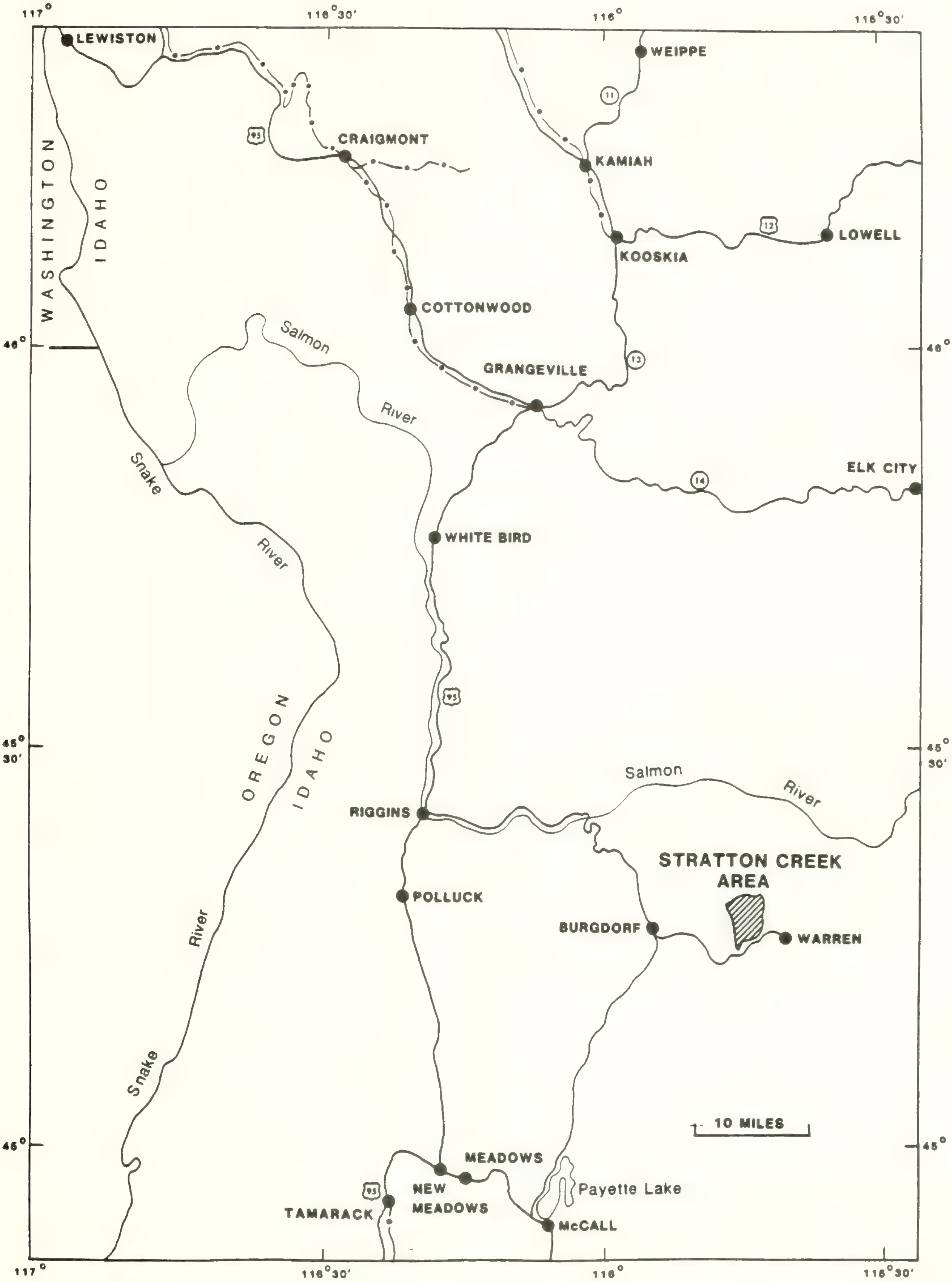

Figure 3-23—Vicinity map for the Stratton Creek area of the Payette National Forest in Idaho.

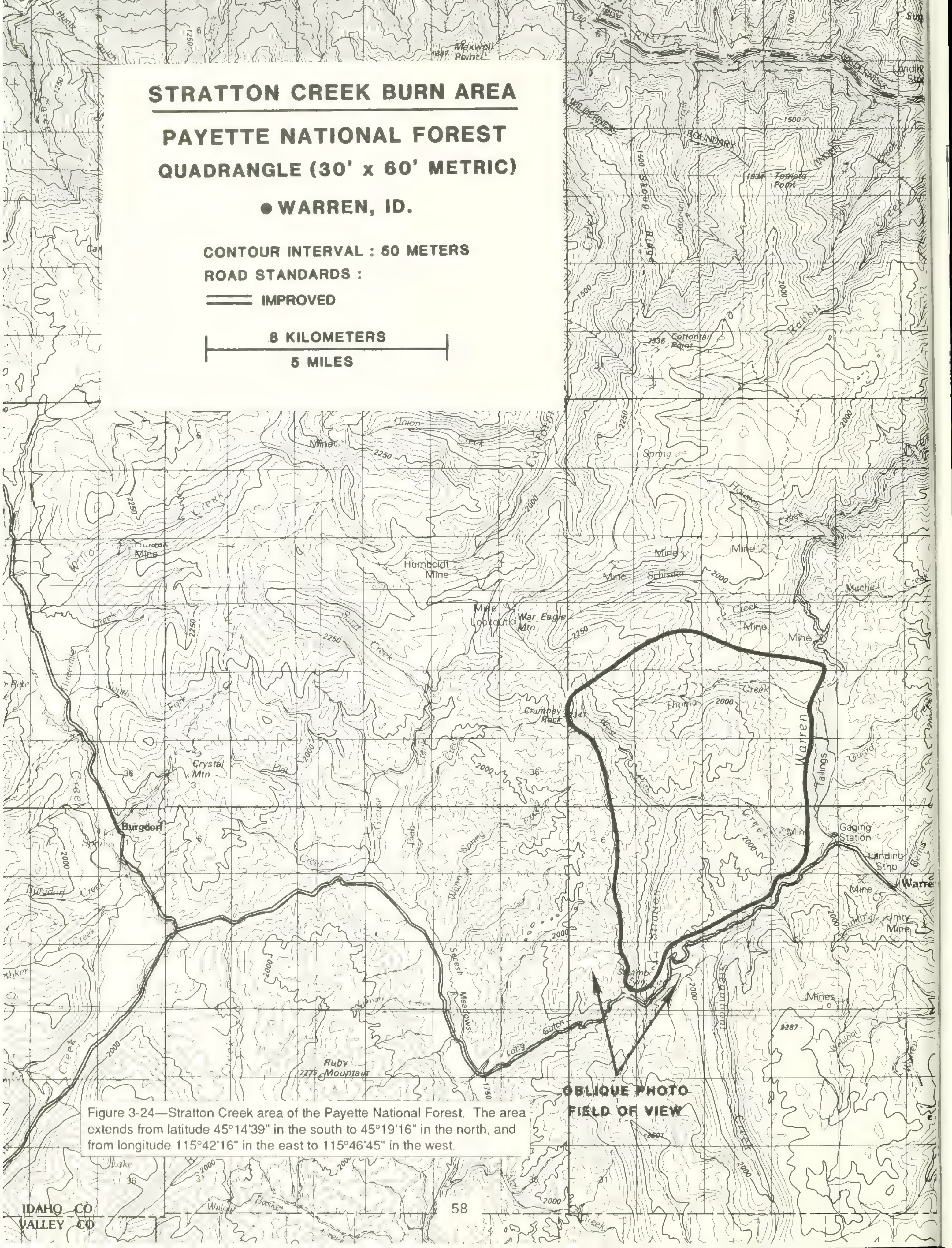

Figure 3-24—Stratton Creek area of the Payette National Forest. The area extends from latitude 45°14'39" in the south to 45°19'16" in the north, and from longitude 115°42'16" in the east to 115°46'45" in the west.

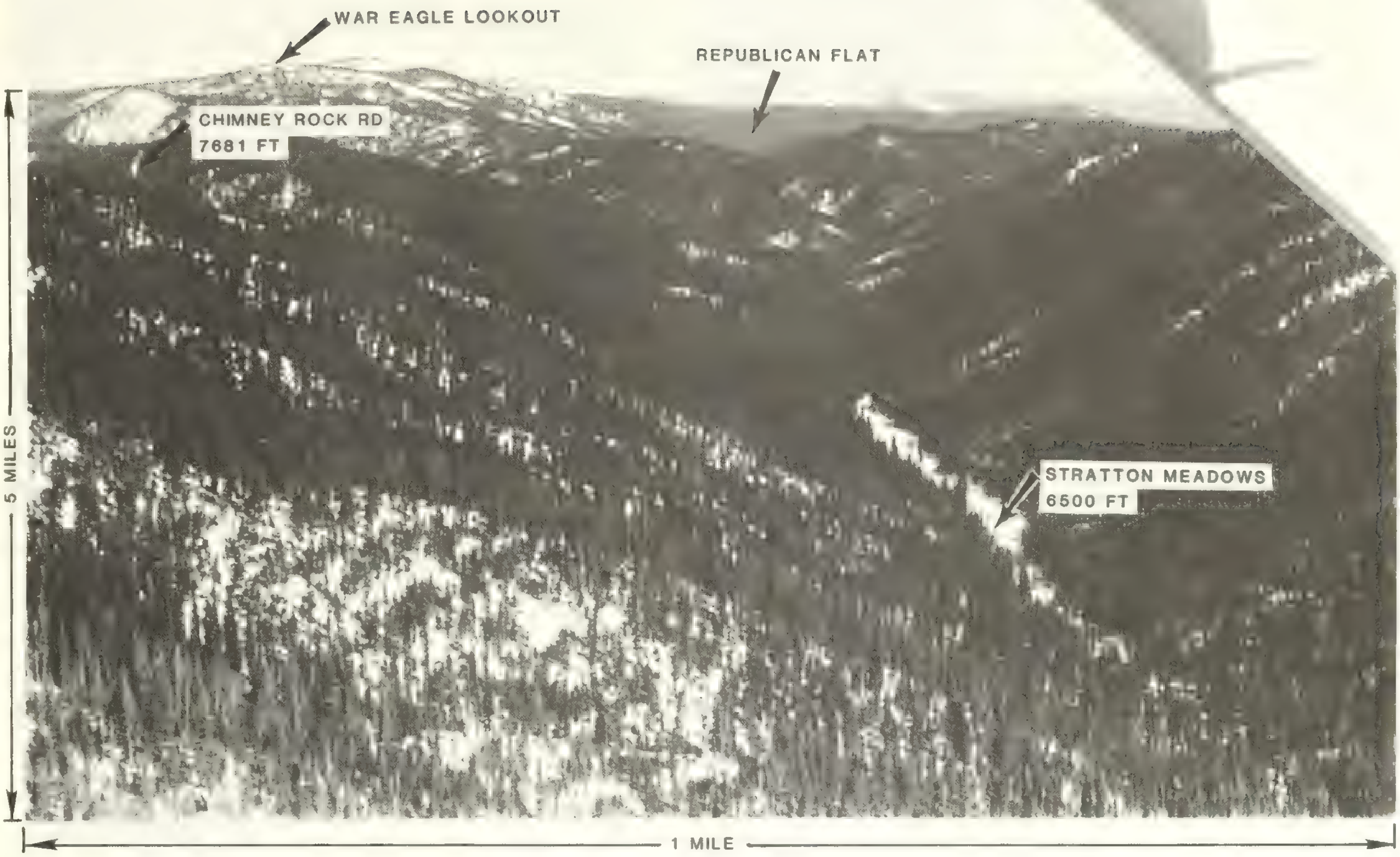

Figure 3-25—Aerial view of the Stratton Creek area of the Payette National Forest looking north from near Steamboat Summit (see fig. 3-24 for viewpoint and field of view). From the foreground to War Eagle Lookout on the left horizon is about 5 miles. The distance east to west in the foreground is about 1 mile.

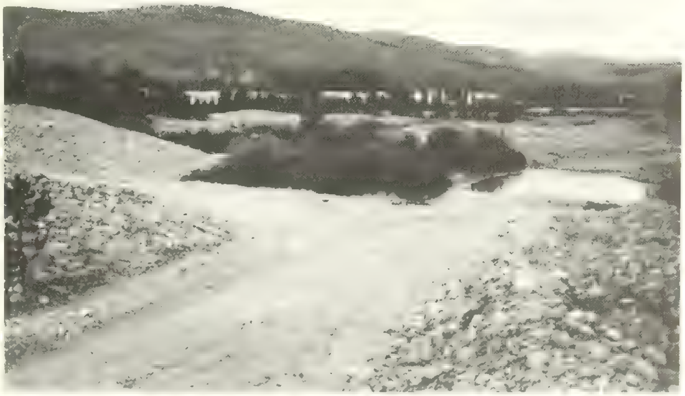

Figure 3-26—View from Warren Creek near the gaging station looking north-northwest over gold-dredge tailings toward pole stands on Thomas Creek and beyond to Republican Flat. The sample point was at extreme left.

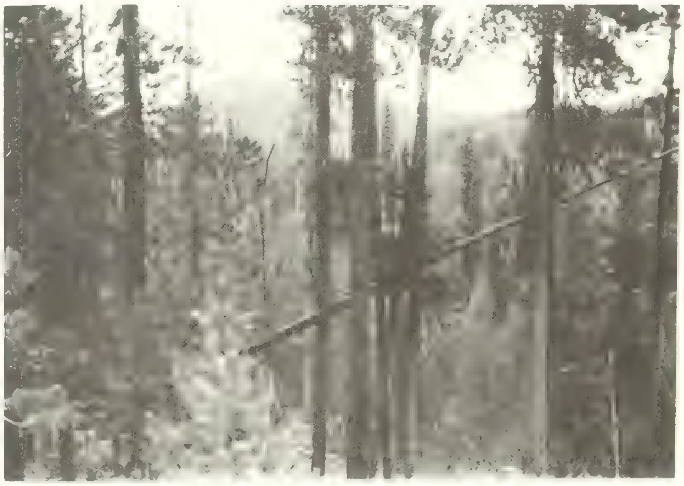

Figure 3-27—Dual-age class stand at about 6,800 feet adjacent to Steamboat Summit and Stratton Creek typical of acreages logged in the 1930's to provide fuel for gold dredges operating in Warren at that time. Mortality in the overstory trees (8 to 10 inches in d.b.h.) is significant.

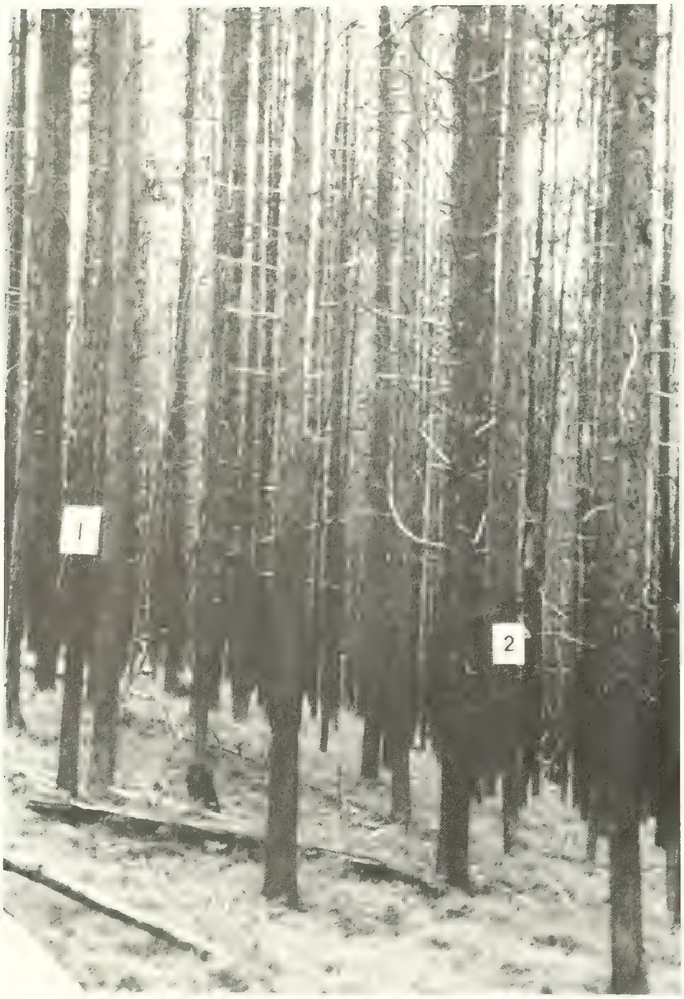

Figure 3-28—Pair of codominant lodgepole pines 3½ to 4 inches in d.b.h. sampled at 5,900 feet just north of Stratton Creek about one-fourth mile west of Warren Creek on the Payette National Forest.

Characteristic	Tree number 1	Tree number 2
D.b.h. (outside bark), inches	3.65	3.88
Tree height above 6-inch high stump, feet	41.5	43.3
Crown ratio, percent	26.5	30.4
Cone serotiny	closed	closed
Tree age years (number of annual growth rings)		
Stump height	78	82
20 percent of tree height	53	60
Base of live crown	33	40
Diameter inside bark, inches		
Stump height	3.76	3.92
20 percent of tree height	3.16	3.51
Base of live crown	1.80	2.12
Height from stump top to base of live crown, inches	366	362
Stem taper inside bark, inches/100 inches		
Below crown	0.54	0.50
Within crown	1.36	1.34
Rings/inch, average for section		
Stump height	41	42
Base of live crown	37	38
Properties of stemwood at 20 percent height		
Moisture content, percent ovendry	60.1	63.6
Specific gravity, ovendry weight and green volume	0.438	0.443
Rings/inch in first 1¼ inches radius	24	28
Maximum crushing strength, lb f/in^2	5,920	5,910
Proportional limit, lb f/in^2	4,440	2,990
Modulus of elasticity, lb f/in^2	980,000	1,100,000
Compression wood evident?	none	none
Spiral grain angle at surface, degrees	3	2
Bark thickness (single), inch	0.10	0.07
Pith eccentricity, inch	0.1	0.1

Inventory Data—Inventory data on the area are incomplete. About 25 percent of the 7,800-acre area carries dual-aged stands of lodgepole (fig. 3-27) and about 75 percent even-aged pole stands (fig. 3-28). Typical stand data for these two stand types have been estimated by experienced managers responsible for the area, as follows:

D.b.h. class	Dual-age timber type	Pole timber type
Inches	*Number of live stems per acre*	
<2.9	600	200
3.0-3.9	120	70
4.0-4.9	120	30
5.0-5.9	18	13
6.0-6.9	18	13
7.0-7.9	12	22
8.0-8.9	12	21
9.0+	20	9
Total	920	378

Cubic Yield Potential and Height Growth—Although not well documented, it is estimated that potential growth rate in managed stands on the area should be about 50 ft^3 per acre per year. Fifty-year height growth in managed stands is estimated at 30 to 90 feet.

Management Objectives for the Area and Constraints—Phased harvest of existing stands and replacement with vigorous natural regeneration managed for stocking control and stand diversity is the major objective of managers of the area. Such stand replacements would be done in a manner to enhance wildlife habitat and watershed values over the long term. That portion of the Warren Creek drainage more than a mile distant from the

Salmon River, while replete with trout, is not considered anadromous fish habitat.

The principal obstacle to accomplishing management objectives is lack of markets for small-diameter lodgepole pine.

Other Lodgepole Pine Available in the Area From Public Lands—In addition to the Stratton Creek area, the Warren Creek drainage of the McCall Ranger District has another 30,000 acres (approximate) of similar lodgepole pine timber type.

Forest Products Industry in the Vicinity—There are no large forest industries immediately adjacent to the area. South and west of McCall there are large sawmills in Cascade, Council, and Tamarack—the latter with a cogeneration powerplant. More distant to the southwest is a large sawmill and plywood plant in Emmett, ID. To the north there are large sawmills in Grangeville and Kooskia. Few of the mills are equipped, however, to efficiently utilize small lodgepole pine logs.

Population in the Vicinity—In 1980 Idaho County had a total population of 14,769; 3,660 reside within the limits of the town of Grangeville—the county seat. The village of Warren has a post office, but only a few year-round residents. In 1983 the annual per-capita income in Idaho County was $8,456, with 11.8 percent of the workforce unemployed.

Valley County, with a population of 6,600, reports 2,568 residing in McCall. The county seat is the railhead town of Cascade (population 1,095). In 1982, annual per-capita income in Valley County was $11,265; 10.8 percent of those in the workforce were unemployed in May 1986. Adams County, which lies immediately west of McCall, had an unemployment rate of 19.9 percent in May 1986.

SALMON NATIONAL FOREST

Area Name and Location—The Leesburg Basin area (figs. 3-29, 3-30, and 3-31), which lies at an elevation of 6,100 to 8,600 feet at latitude 45°13' and longitude 114°07', is in the Cobalt Ranger District of the Salmon National Forest. The Ranger Station is in Salmon (Cobalt in summer only).

The gross area of about 31,700 acres is essentially all forested with lodgepole pine timber type. It falls entirely within Lemhi County; Salmon is the county seat. The area is centered around the old (virtually deserted) mining town of Leesburg, which is about 11 miles south of the Salmon River and 11 air miles northwest of the town of Salmon on a heading of 287°.

Maps of the Area—USGS quadrangle 15' maps needed to depict the area are: Ulysses Mountain and Leesburg.

Access—The most direct road access is south from Salmon 6 miles by paved road (U.S. Highway No. 93) to a gravel road running 13 miles northwest up Williams Creek to a 7,814-foot divide, then 7 miles down Moccasin Creek to its confluence with Napius Creek, and hence north on an unimproved dirt road 6.4 miles to Leesburg town site—a total road distance from Salmon to Leesburg of 32.4 miles. The area can also be reached from the gravel road that runs through Cobalt along Panther Creek to Shoup and North Fork on the Salmon River.

From Salmon, ID, railheads are distant, as follows:

Darby, MT (via 7,014-foot Lost Trail Pass)	77 miles
Red Rock siding south of Dillon, MT	90 miles
Arco, ID	138 miles
Roberts, ID	144 miles

For highway distances from Darby, MT, to various market centers in the United States, see table 1-2.

Terrain and Soil—As previously noted, the timbered area lies between 6,100 and 8,600 feet elevation, with more than 90 percent of the acreage having slopes of less than 45 percent (fig. 3-31). There are no special terrain obstacles to harvesting.

Approximately 10 percent of the area has clayey soils derived from Challis Volcanics. About 35 percent of the soils are granitics, generally sandy loam or loamy sands. Most of the remaining soils are derived from quartzite parent material and are quite thin, with a high percentage of angular gravel and cobble. The quartzite soils are quite resistant to erosion due to the rock fragments.

Annual Precipitation and Duration of Snow-free Season—Annual precipitation totals about 25 inches, with several feet of snow accumulation common in winter. The snow-free season along Napius Creek is generally from mid-May to mid-October.

General Character of the Timber—Of the total area of 31,700 acres, perhaps 25 percent is in old-growth sawtimber, mostly 9 to 11 inches in d.b.h. About 15 percent of the acreage is in pole stands (fig. 3-32). Most of the rest is in uneven-aged stands with timber of low quality (figs. 3-33, 3-34, and 3-35).

In the early 1930's there was a major mountain pine beetle infestation throughout the area, but current mortality from beetles is not evident. This epidemic had a significant impact on current stand conditions, yielding a high percentage of low-quality, low-volume stands. A significant proportion of trees observed along Napius Creek have cankers (fig. 3-34) and/or fire scars on the lower one-third of stems. Dwarf mistletoe infestation is prevalent.

The last fires that burned significant portions of the area occurred around 1900. In the late 1800's and early 1900's timber was cut to clear areas for placer mining, and to produce the firewood and lumber needed for mining activities.

Currently there is no significant managed harvesting activity in the area. The Salmon National Forest draft Forest Plan lists the Leesburg area in Management Area 5B, with emphasis on medium levels of timber outputs and investments. Currently (November 1986) the Plan calls for a 10-year timber harvest of about 14 million bd ft of sawtimber (Scribner log scale) from about 2,000 acres of the study area. This would require about 40 miles of permanent roads and is dependent on timber market conditions. Planned 10-year harvest of about 12 million bd ft of timber from adjacent areas will be dependent on this road system and market conditions.

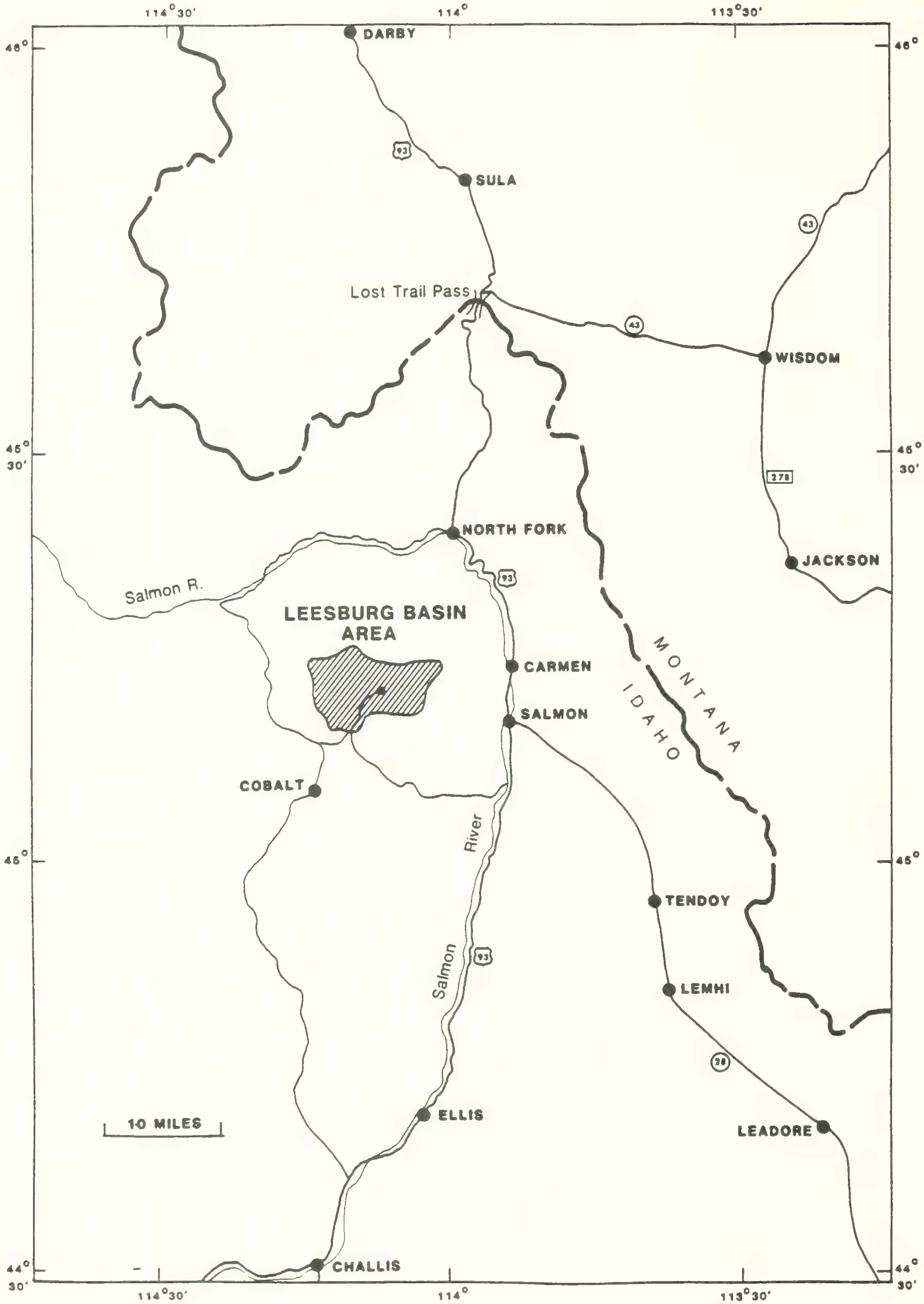

Figure 3-29—Vicinity map for the Leesburg Basin area of the Salmon National Forest in Idaho.

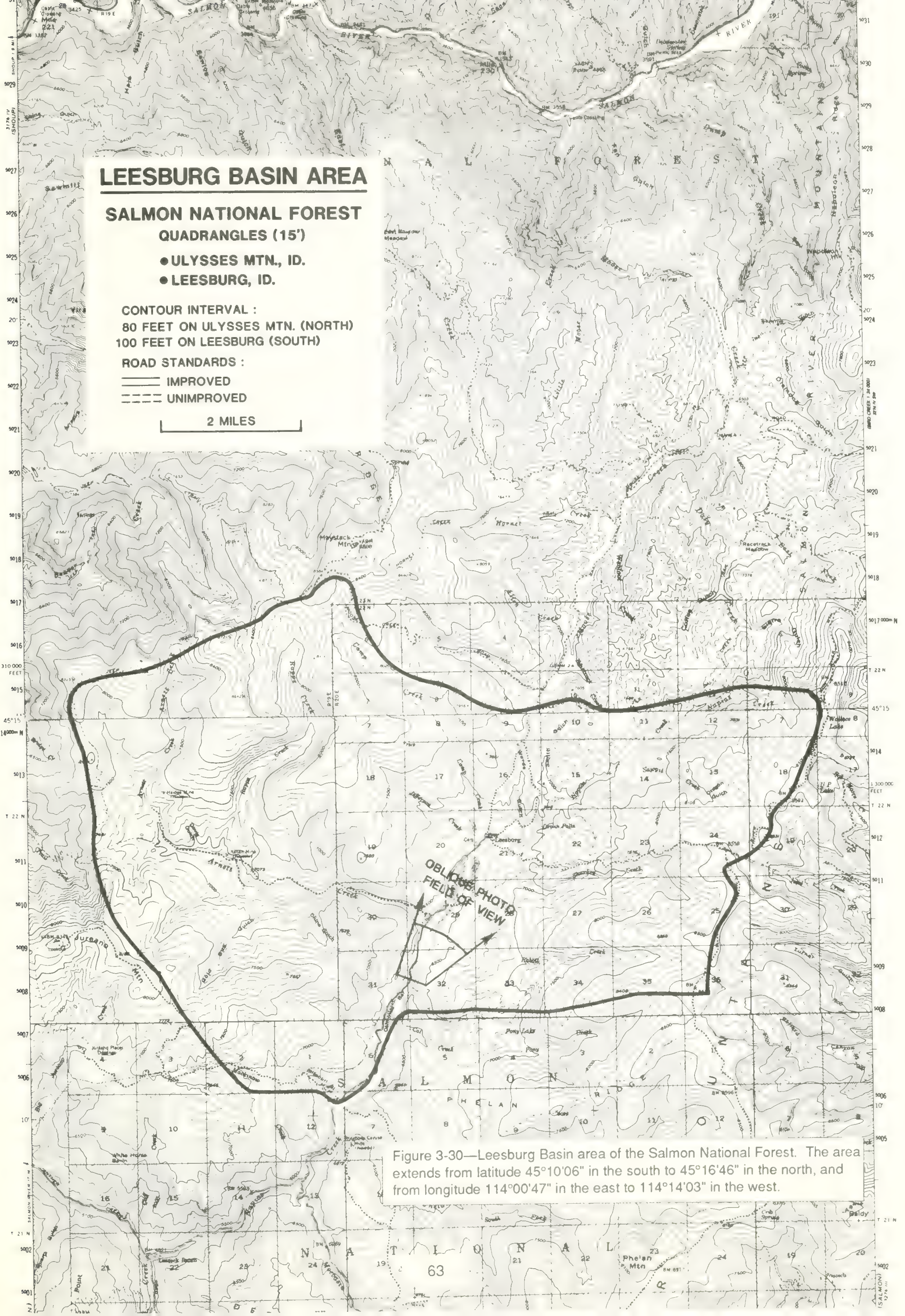

Figure 3-30—Leesburg Basin area of the Salmon National Forest. The area extends from latitude 45°10'06" in the south to 45°16'46" in the north, and from longitude 114°00'47" in the east to 114°14'03" in the west.

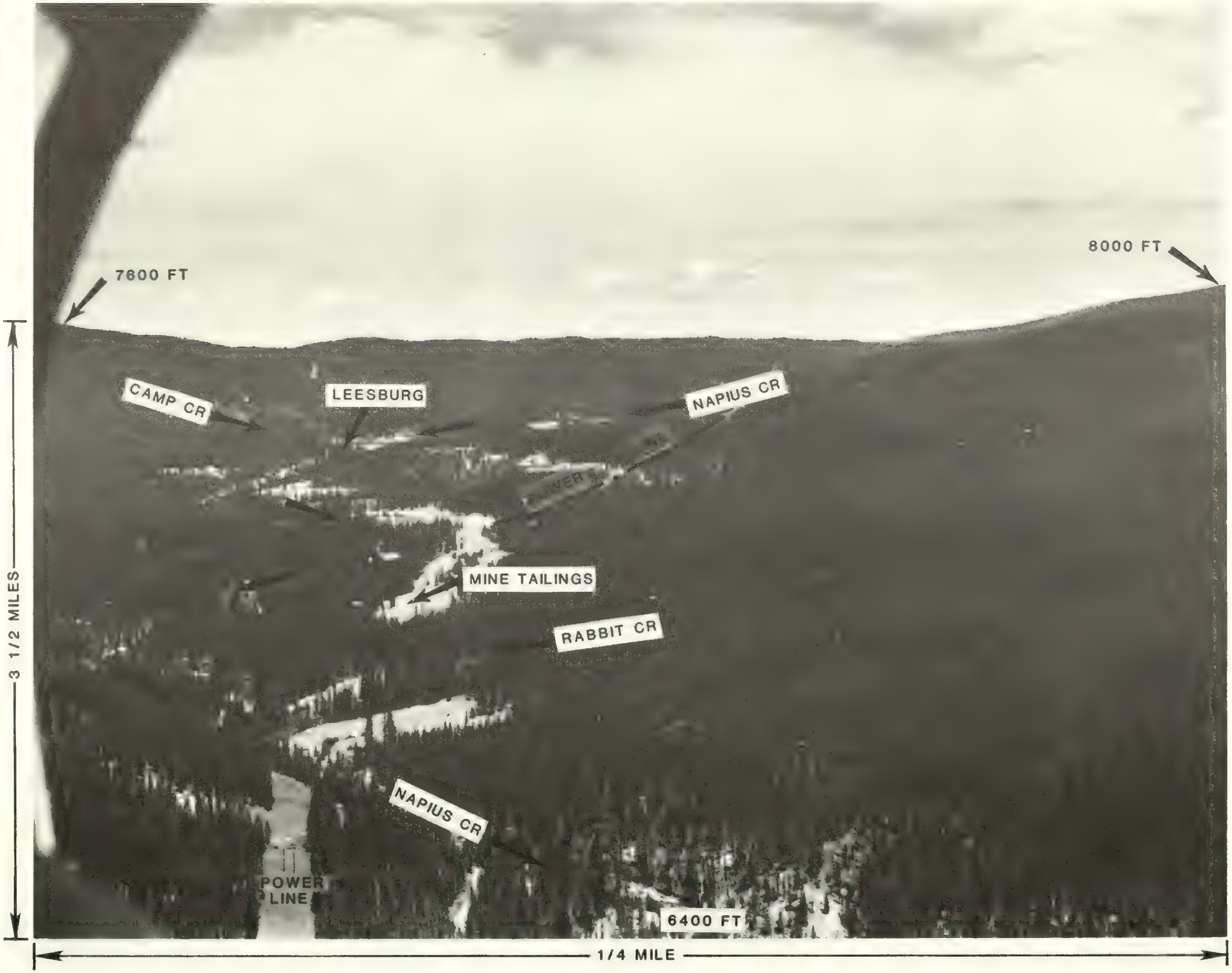

Figure 3-31—Oblique view of the Leesburg Basin area of the Salmon National Forest looking northwest up Napius Creek toward Leesburg from a point just south of the confluence of Napius Creek and Rabbit Creek; see figure 3-30 for camera viewpoint and field. Width of the foreground shown is about one-fourth mile; from the foreground to the left skyline is about 3½ miles.

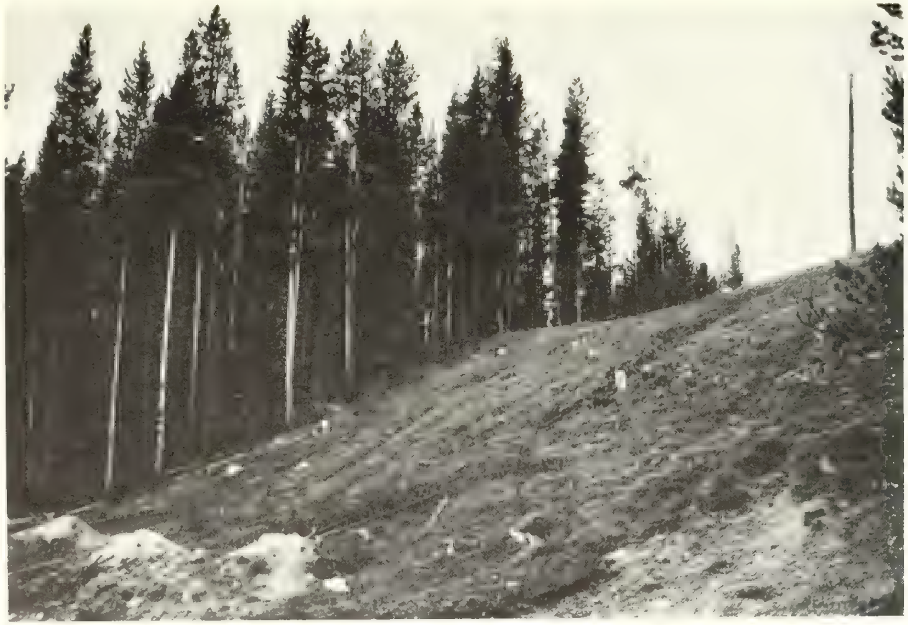

Figure 3-32—Even-aged pole stand of lodgepole pine with edge exposed by powerline right-of-way near junction of Napius Creek and Arnett Creek (6,400 feet elevation).

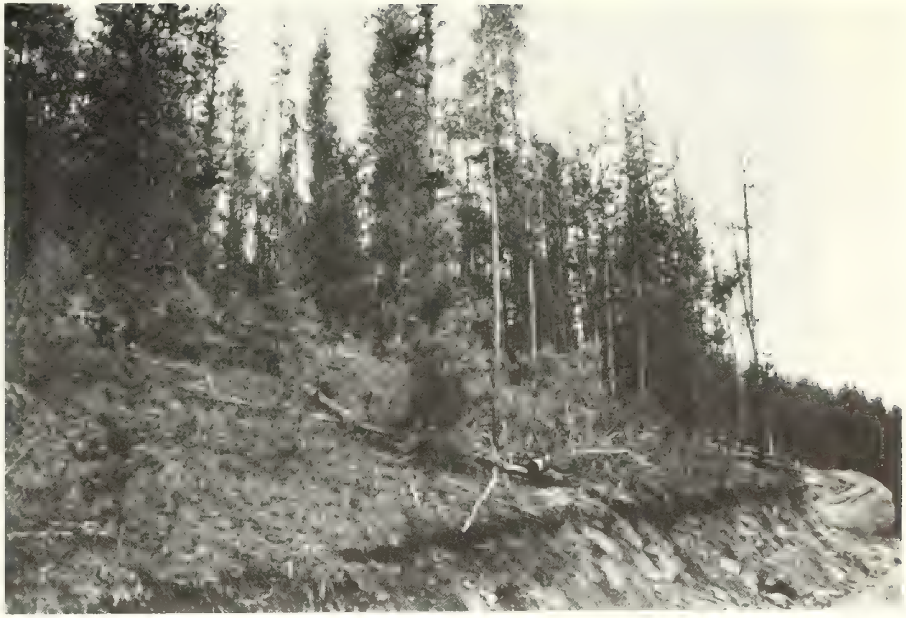

Figure 3-33—Uneven-aged lodgepole stand just west of Napius Creek between Arnett Creek and Jefferson Creek in the Leesburg Basin area of the Salmon National Forest. Trees are cankered and have mistletoe; larger trees are probably relicts from past bark beetle attacks.

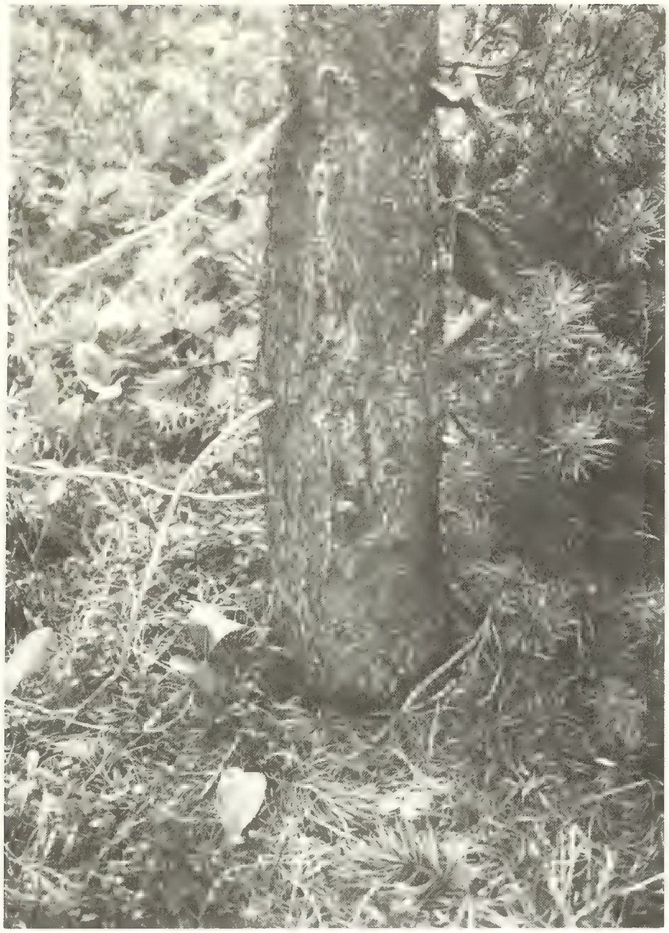

Figure 3-34—Cankers in lower third of stem are common in stands adjacent to Napius Creek in the Leesburg Basin area of the Salmon National Forest.

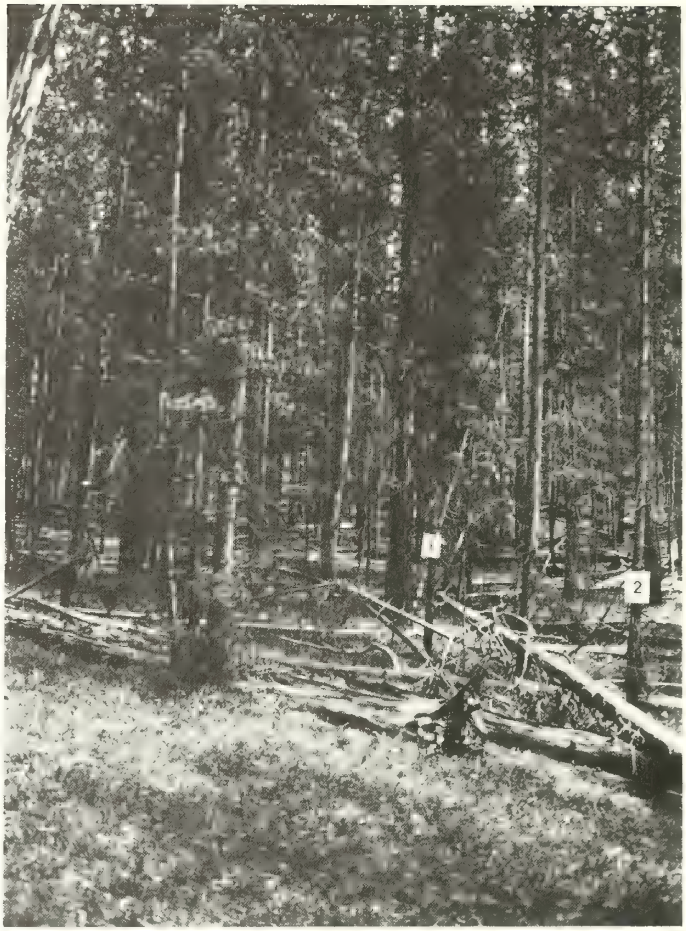

Figure 3-35—Pair of sample trees 3½ to 4 inches in d.b.h. in tall understory of uneven-aged stand at 6,500 feet near Rabbit Creek in the Leesburg Basin area of the Salmon National Forest.

Data on Sample Trees—A pair of adjacent 3½- to 4-inch trees from the tall understory were destructively sampled at 6,500 feet from an uneven-aged stand on level terrain not far from Rabbit Creek (fig. 3-35). Some pertinent tree characteristics follow. These tabulated data should not be interpreted as statistically representative of all trees.

See appendix for an explanation of tree selection and procedures for evaluation of mechanical properties in compression parallel to the grain at 10 percent moisture content.

Characteristic	Tree number 1	Tree number 2
D.b.h. (outside bark), inches	3.26	3.38
Tree height above 6-inch high stump, feet	30.0	28.3
Crown ratio, percent	65	65
Cone serotiny	- no observation -	
Tree age years (number of annual growth rings)		
Stump height	78	46
20 percent of tree height	59	29
Base of live crown	34	26

Characteristic	Tree number 1	Tree number
Diameter inside bark, inches		
Stump height	4.00	3.32
20 percent of tree height	2.82	3.13
Base of live crown	2.19	2.62
Height from stump top to base of crown, inches	126	120
Stem taper inside bark, inches/ 100 inches		
Below crown	1.44	0.58
Within crown	0.94	1.19
Rings/inch, average for section		
Stump height	37	28
Base of live crown	31	20
Properties of stemwood at 20 percent height		
Moisture content, percent ovendry	98.8	91.6
Specific gravity, ovendry weight and green volume	0.374	0.394
Rings/inch in first $1\frac{1}{4}$ inches radius	47	18
Maximum crushing strength, lb f/in^2	5,390	4,530
Proportional limit, lb f/in^2	3,230	2,620
Modulus of elasticity, lb f/in^2	900,000	980,000
Compression wood evident?	none	none
Spiral grain angle at surface, degrees	0	0
Bark thickness (single), inch	0.09	0.14
Pith eccentricity, inch	0	0.1

Inventory Data—Inventory data for the area are incomplete, particularly in stands with trees of small diameter. As noted previously, about 25 percent of the acreage is in old-growth lodgepole pine sawtimber, about 15 percent in pole stands, and most of the balance in uneven-aged stands of low quality. Managers responsible for the area note that stands are variable, but estimate typical stand data for these three timber types as follows:

D.b.h. class	Old-growth sawtimber	Pole timber	Uneven-aged timber
Inches	*- - - Number of live stems per acre - - -*		
<2.9	1,552	695	1,010
3.0-3.9	54	792	45
4.0-4.9	71		61
5.0-5.9	57	306	76
6.0-6.9	43		78
7.0-7.9	33	94	35
8.0-8.9	29		21
9.0+	64	17	46
Total	1,903	1,904	1,372

Cubic Yield Potential and Height Growth—Estimates from 49 stands in the north portion of Leesburg Basin suggest that average potential mean annual increment in this portion of the area is about 29 ft^3 per acre per year, with 95 percent of the stands yielding 16 to 42 ft^3 per acre per year. In these same stands, 50-year height growth averaged 32 feet, with 95 percent of the stands having 25- to 39-foot height growth in 50 years.

The managers estimate that average potential mean annual increment for the entire area is 35 ft^3 per acre per year, with 50-year height growth in managed stands of 35 feet.

Management Objectives for the Area and Constraints—Phased harvest and natural regeneration with vigorous, controlled-density stands of lodgepole pine is a major objective of the managers. Such new stands would be at less risk from mountain pine beetle attack than the present stands. Harvest activity, if it can be scheduled, will be conducted to protect and enhance wildlife habitat and visual and watershed values.

The major obstacle to accomplishment of the objective is lack of markets for low-quality and small-diameter lodgepole pine trees.

Other Lodgepole Pine Available in the Area From Public Lands—In addition to the lodgepole pine in the Leesburg Basin area, the Salmon National Forest has another 30,000 acres of similar timber adjoining to the north in the Moose Creek drainage, and a few miles to the south on Pepper Creek Ridge.

Forest Products Industry in the Vicinity—Forest industries closest to the area are those in the vicinity of Salmon, where there is a medium-size sawmill cutting Douglas-fir dimension lumber, a custom sawmill with a post-and-pole operation, a plant that manufactures laminated beams (mostly Douglas-fir), and another post-and-pole operation. Two additional mills are located in Darby, 77 miles from Salmon. All of these sawmills prefer larger logs than provided by most of the lodgepole pine forests of the area. The nearest pulpmill is near Missoula, about 150 miles from Salmon.

Population in the Vicinity—Lemhi County has a total population of 7,460 (1980); 3,514 reside in Salmon. In 1982 the average per-capita income in Lemhi County was $7,435. In 1985, 9.4 percent of the workforce was unemployed.

Ravalli County, MT, with a population of 24,800 people in 1984, has the nearest railhead town—Darby (population 581). In 1983, per-capita income in the county averaged $8,014; 10.3 percent of those in the workforce were unemployed in February 1986.

REFERENCES

Benson, Robert E.; Green, Alan W.; Van Hooser, Dwane D. 1987. Idaho's forest resources. Resour. Bull. INT-39. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 114 p.

Van Hooser, Dwane D.; Chojnacky, David C. 1983. Whole tree volume estimates for the Rocky Mountain States. Resour. Bull. INT-29. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 69 p.

CHAPTER 4: MONTANA

INTRODUCTION

In Montana, lodgepole pine predominates on about 3.9 million acres of the State's 13.6 million acres of commercial forest land, with about 8.4 billion ft^3 of lodgepole pine growing stock and 18.7 billion bd ft of sawtimber (table 4-1). Approximately 33 percent of the softwood growing stock and 21 percent of the softwood sawtimber in the State is lodgepole pine (Green and others 1985).

Approximately 64 percent of the dry weight of needle-free aboveground biomass of lodgepole pine trees in Montana is in trees smaller than the 10-inch d.b.h. class (table 4-2).

The five areas selected for study by managers of public forest land in Montana (fig. 4-1) total 56,000 acres in gross area; they are individually described in the following text.

Table 4-1—Volume of lodgepole pine growing stock and sawtimber, and acreage in lodgepole pine, by ownership class, Montana[1]

Ownership class	Growing stock[2]	Sawtimber volume[3]	Commercial timberland area
	Million ft^3	*Million bd ft International 1/4-inch scale*	*Thousand acres*
National Forest (commercial)[4]	6,660.6	15,094.1	3,100.0
Other public	280.9	634.3	114.3
Forest industry	641.4	1,098.3	306.7
Other private	787.5	1,842.2	344.5
Total	8,370.4	18,668.9	[4]3,865.5

[1] Source: Green and others (1985). Information presented is based on 1980 data.

[2] **Growing stock volume** = net volume in cubic feet of live sawtimber and pole timber trees (5 inches d.b.h. and larger) from stump to a minimum 4-inch top outside bark, or to the point where the central stem breaks into limbs.

[3] **Sawtimber volume** = net volume in board feet of the sawlog portion of live sawtimber trees. Sawtimber trees are live trees of commercial species, 9 inches in d.b.h. or larger (softwood), containing at least one 12-foot sawlog or two noncontiguous 8-foot sawlogs, and meeting regional specifications for freedom from defect.

[4] **Commercial timberland** = forest land that is capable of producing crops of industrial wood and not withdrawn from timber utilization by statute or administrative regulation. Areas qualifying as commercial timberland have the capability of producing in excess of 20 ft^3 per acre per year of industrial wood in natural stands.

Table 4-2—Dry weight of lodgepole pine trees, by tree component and diameter class—Montana[1]

Diameter class	Bole[2]	Top[2]	Total
Inches	*- - Thousand tons, ovendry basis - -*		
2	—	6,509	6,509
4	—	21,301	21,301
6	30,654	16,883	47,537
8	35,351	9,120	44,471
10	25,842	6,248	32,090
12	15,864	3,893	19,757
14	7,485	1,669	9,154
16	3,129	637	3,766
18	1,123	225	1,348
20+	795	154	949
Total	120,243	66,639	186,882

[1] Source: Van Hooser and Chojnacky (1983).

[2] **Trees 5+ inches d.b.h.**: Bole weight = ovendry weight of wood and bark from a 1-foot stump to a 4-inch top diameter, inside bark; top weight = ovendry weight of wood and bark from a 4-inch diameter to tip of tree, plus branch material down to 1/4-inch diameter.

Trees less than 5 inches d.b.h: Total ovendry weight of wood and bark from a 1-foot stump to tip of tree, plus branch material down to 1/4-inch diameter (tabulated under "Top").

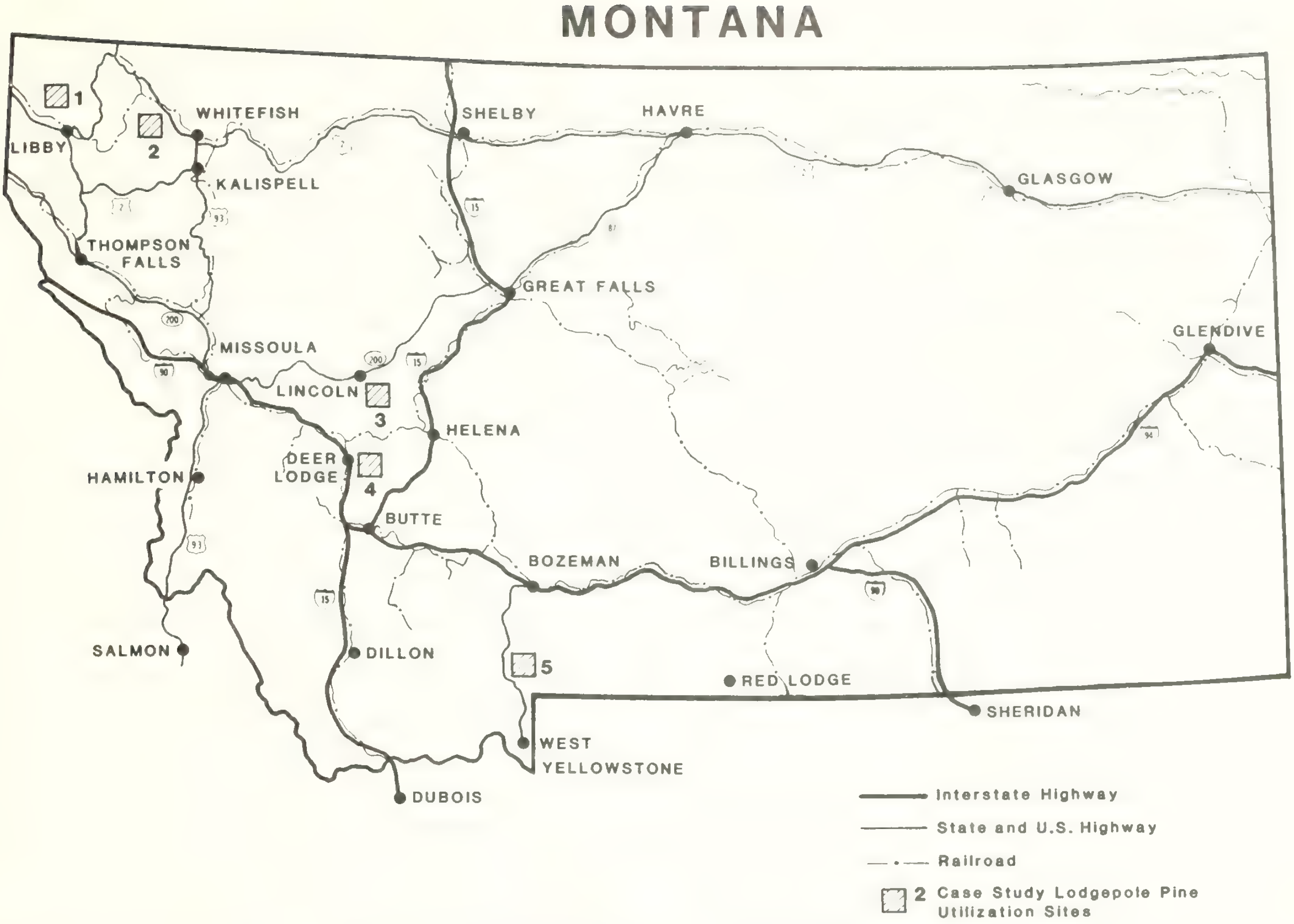

Figure 4-1—Montana location map. 1. Kootenai NF (Zulu-Smoot) 5,000 acres. 2. Flathead NF (Good Creek Burn) 17,000 acres. 3. Helena NF (Poorman Creek) 5,000 acres. 4. Deerlodge NF (Cottonwood Creek) 3,000 acres. 5. Gallatin NF (Goose-Levinski) 7,000 acres.

DEERLODGE NATIONAL FOREST

Area Name and Location—The Cottonwood Creek area (figs. 4-2, 4-3, and 4-4), which lies at an elevation of 5,500 to 7,850 feet at latitude 46°21' and longitude 112°34', is in the Deer Lodge Ranger District of the Deerlodge National Forest; the Ranger Station is in Deer Lodge.

The gross area of 3,000 acres includes about 2,400 acres of lodgepole pine timber type, and falls entirely within Powell County; Deer Lodge is the county seat. The area is centered around the Middle Fork of Cottonwood Creek just west of the Continental Divide and is 8 air miles east-southeast of Deer Lodge on a heading of 105°. From Butte, the area is 24 air miles due north.

Map of the Area—Only one USGS quadrangle 15' map (Deer Lodge, MT) is needed to depict the area.

Access—A good gravel road runs east from Deer Lodge 11 miles to where it first crosses the Middle Fork of Cottonwood Creek at the border of the central body of timber (elevation 5,600 feet). From this point one branch of the road climbs southeast to about 6,800 feet and again crosses the Middle Fork 4.1 miles upstream from the initial crossing. Another branch of the road continues south through the area and returns in a southerly loop to Deer Lodge. An unimproved dirt road reaches the border of the northern body of timber but does not penetrate it (fig. 4-3).

Deer Lodge (elevation 4,521 feet) is the nearest railhead. For highway distances from Deer Lodge to various market centers in the United States, see table 1-2.

Terrain and Soil—As noted previously, the timber lies between 5,500 and 7,850 feet, with about nine-tenths of the acreage having slopes less than 45 percent. Soils are rocky; they are of volcanic origin but have little of the ash overlay common in extreme northwestern Montana. See figures 4-5 and 4-6 for soil profiles exposed in road cuts.

Annual Precipitation and Duration of Snow-free Season—Annual precipitation totals 25 to 30 inches. The snow-free season generally extends from June 1 through October.

General Character of the Timber—Within the delineated area, stands are extremely variable from pole stands (fig. 4-5) to thickets of stagnated small stems (fig. 4-6).

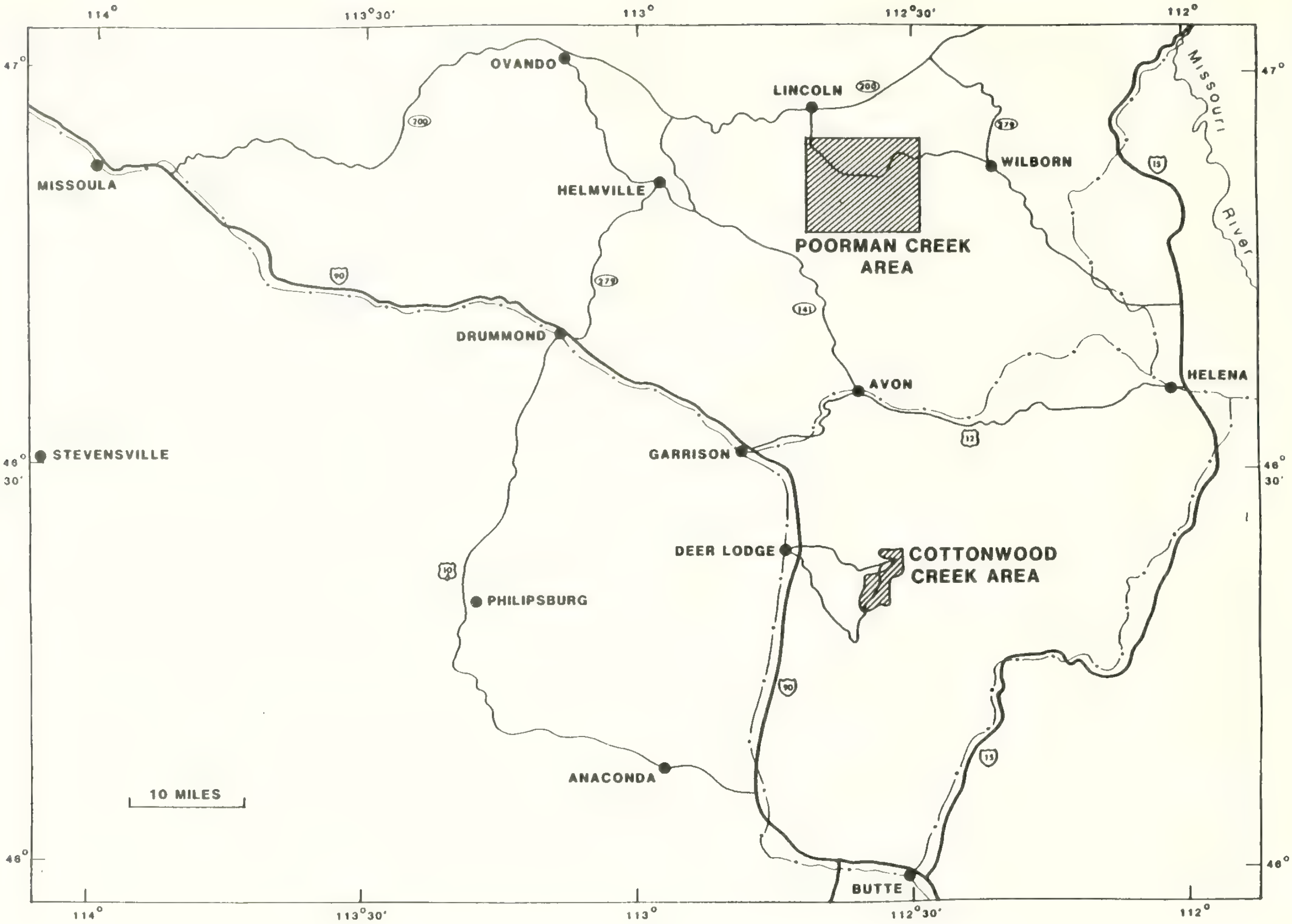

Figure 4-2—Vicinity map for the Cottonwood Creek area (Deerlodge National Forest) and the Poorman Creek area (Helena National Forest), both in Montana.

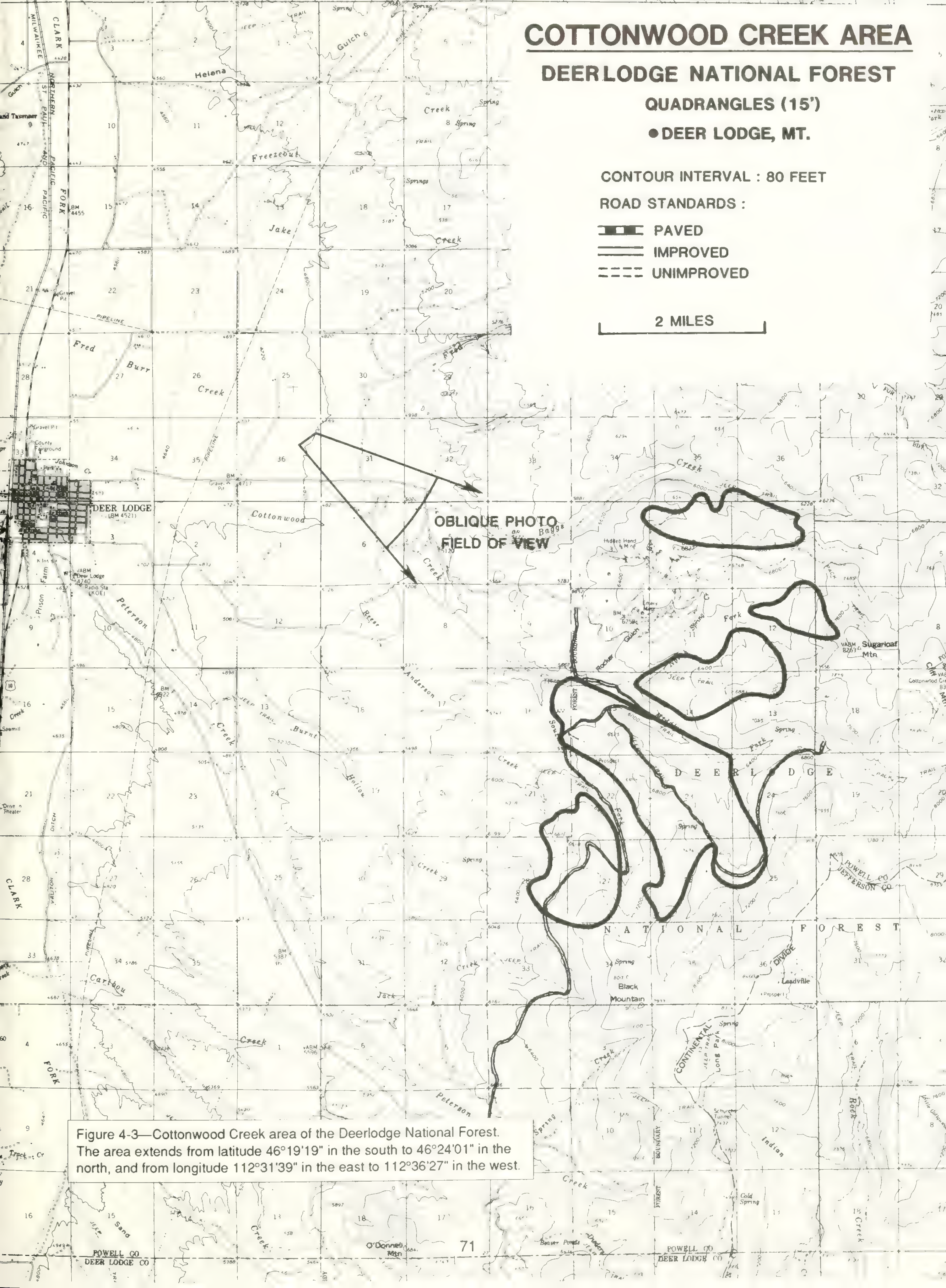

Figure 4-3—Cottonwood Creek area of the Deerlodge National Forest. The area extends from latitude 46°19'19" in the south to 46°24'01" in the north, and from longitude 112°31'39" in the east to 112°36'27" in the west.

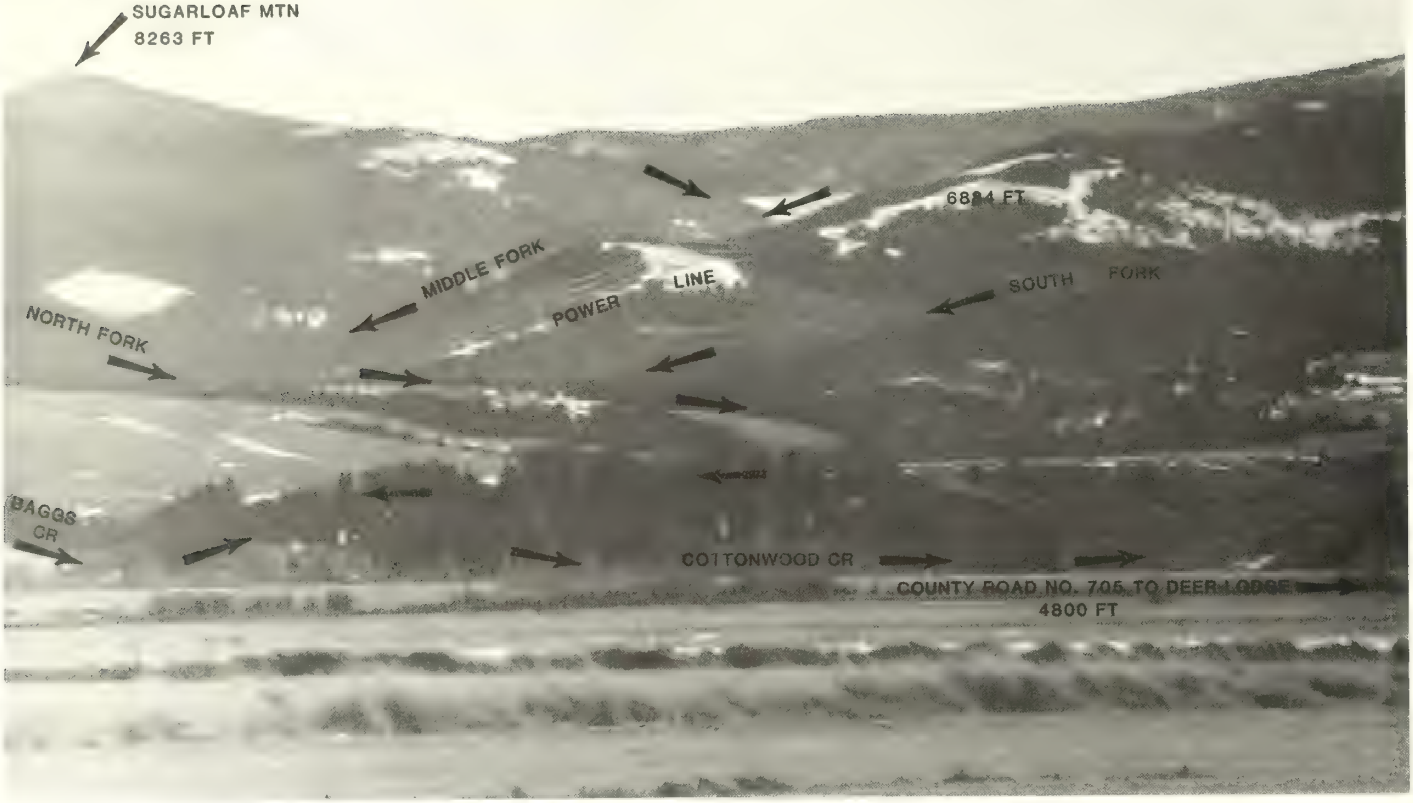

Figure 4-4—Oblique view of the Cottonwood Creek area of the Deerlodge National Forest looking southeast from near the confluence of Baggs Creek and Cottonwood Creek. See figure 4-3 for camera field of view. The distance from Cottonwood Creek in the foreground to Sugarloaf Mountain is about 12 miles. Distance along the skyline ridge is about 7 miles.

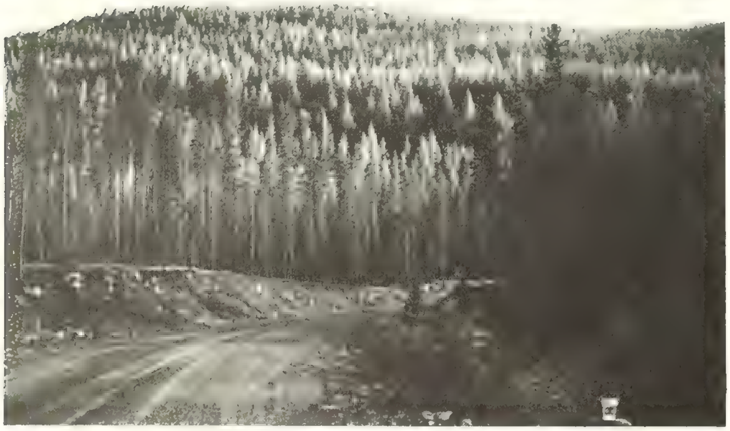

Figure 4-5—Pole stand of lodgepole looking south from the Middle Fork of Cottonwood Creek at 5,680 feet on the Deerlodge National Forest.

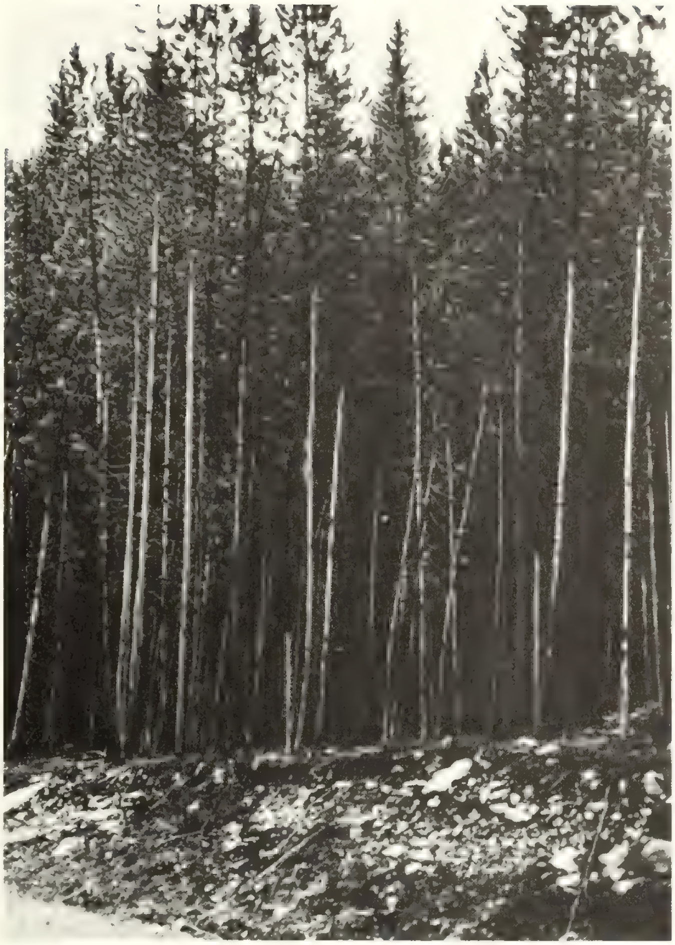

Figure 4-6—Dense, stagnated stand of lodgepole pine at about 6,800 feet just south of the Middle Fork of Cottonwood Creek on the Deerlodge National Forest. The trees measure less than 3 inches in d.b.h.

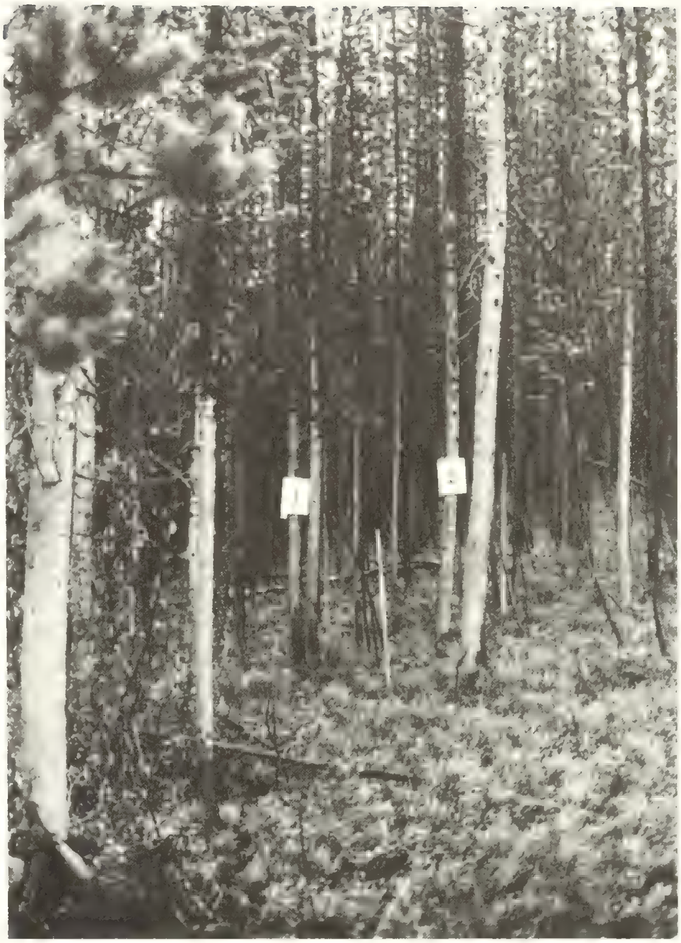

Figure 4-7—Pair of codominant lodgepole pines 3½ to 4 inches in d.b.h. sampled at 6,700 feet a little north of the Middle Fork of Cottonwood Creek on the Deerlodge National Forest. The stadia rod has 1-foot markings.

Only a small proportion of the trees are large enough to yield house logs or poles. Perhaps 600 acres of the 2,400 acres of lodgepole pine timber type are in thickets of stagnated small stems.

Trees are fairly tall and of good form, with little dwarf mistletoe infestation. Considerable porcupine damage is evident—mostly close to ground level. Mortality from mountain pine beetle attack is not evident.

Harvest activity has been limited to a few small post-and-pole operations, and no large harvests are planned.

Data on Sample Trees—A pair of adjacent codominants 3½ to 4 inches in d.b.h. were destructively sampled at an elevation of 6,700 feet slightly north of the Middle Fork of Cottonwood Creek (fig. 4-7). Some pertinent tree characteristics follow. These tabulated data should not be interpreted as statistically representative of all trees.

See appendix for an explanation of tree selection and procedures for evaluation of mechanical properties parallel to the grain at 10 percent moisture content.

Characteristic	Tree number 1	Tree number 2
D.b.h. (outside bark), inches	3.95	3.95
Tree height above 6-inch high stump, feet	32.0	36.8
Crown ratio, percent	42	71
Cone serotiny	- no observation -	
Tree age years (number of annual growth rings)		
Stump height	80	80
20 percent of tree height	62	64
Base of live crown	34	63
Diameter inside bark, inches		
Stump height	4.10	3.99
20 percent of tree height	3.43	3.50
Base of live crown	2.60	3.33
Height from stump top to base of crown, inches	222	126
Stem taper inside bark, inches/100 inches		
Below crown	0.68	0.52
Within crown	1.60	1.06
Rings/inch, average for section		
Stump height	39	40
Base of live crown	26	38
Properties of stemwood at 20 percent height		
Moisture content, percent ovendry weight	114.1	105.4
Specific gravity, ovendry weight and green volume	0.403	0.462
Rings/inch in first 1¼ inches radius	27	35
Ultimate compresssive strength, lb f/in^2	6,150	6,890
Proportional limit, lb f/in^2	3,500	4,160
Modulus of elasticity, lb f/in^2	1,500,000	1,460,000
Compression wood evident?	none	none
Spiral grain angle at surface, degrees	0	1
Bark thickness (single), inch	0.15	0.14
Pith eccentricity, inch	0.1	0.1

Inventory Data—Inventory data are incomplete for the area. As previously noted, about 25 percent of the lodgepole acreage is in stagnated thickets of small trees (typified by stand No. 12407002 of 54 acres). Most of the balance of the lodgepole acreage carries pole stands with trees 3 to 5 inches in d.b.h. predominating (typified by stand No. 12504004 of 207 acres). Data on the lodgepole live-tree component of these two stands are as follows:

D.b.h. class	Stagnated thickets		Pole stands	
Inches	*Trees / acre*	*Feet in height*	*Trees / acre*	*Feet in height*
1.0-2.9	2,940	16	925	23
3.0-4.9	720	25	1,100	37
5.0-6.9	277	40	268	43
7.0-8.9	11	42	37	46
9.0-13.9	9	—	9	49
Total	3,957		2,339	

Cubic Yield Potential and Height Growth—Although not well documented, managers of the area estimated that the current lodgepole pine stands are growing about 20 ft^3 per acre per year; the potential is estimated at about 40 ft^3 per acre per year. Fifty-year height growth in managed stands is estimated at about 40 feet, but is highly variable over the area.

Management Objectives for the Area and Constraints—A major objective of the managers is phased harvest of the area (particularly the stagnated thickets) and replacement with vigorous, controlled-density stands of lodgepole pine. Such new stands would be at less risk from mountain pine beetle, and if harvests are timed appropriately, could enhance elk and deer habitat and protect watershed and esthetic values. To this end, the managers are of the opinion that about 30 acres could be clearcut annually in the delineated area.

The major obstacle to accomplishing this objective is lack of markets for the thicket-grown and other small-diameter lodgepole.

Other Lodgepole Pine Available in the Area From Public Lands—Exclusive of timber in the Flint Range/Dolus Roadless Area, there are an additional 4,000 to 5,000 acres of similar lodgepole pine timber on the Deerlodge National Forest.

Forest Products Industry in the Vicinity—Sawmills manufacturing 2- by 4-inch studs operate in Deer Lodge, Drummond, and Hall. Post-and-pole manufacturers operate in Deer Lodge, Lincoln, Philipsburg, Hall, Drummond, Avon, and Helena; the largest operation is in Lincoln.

In the vicinity of Missoula (about 80 miles distant) there are several sawmills, a particleboard plant, and a kraft pulp mill.

Population in the Vicinity—Powell County has a total population (1984) of 6,958; of this total, 4,023 live in Deer Lodge. In 1983 the average family income in Powell County was $17,239; per-capita income in 1984 was $11,343. In 1986, 17 percent of those in the workforce were unemployed (because of diminished mining, smelting, and railroad activity).

FLATHEAD NATIONAL FOREST

Area Name and Location—The Good Creek Burn area (figs. 4-8, 4-9, and 4-10), which lies at an elevation of 3,800 to 5,800 feet at latitude 48°29' and longitude 114°43', is in the Tally Lake Ranger District of the Flathead National Forest; the Ranger Station is in Whitefish.

The gross area of about 16,000 acres is essentially all lodgepole pine timber type and falls entirely within Flathead County; Kalispell is the county seat. The area is centered around Good Creek, 19 air miles northwest from Whitefish on a heading of 285°. The east border of the area is 10 air miles due west of the north end of Whitefish Lake.

Maps of the Area—USGS quadrangle 7½' maps needed to depict the area are: Sunday Mountain, Radnor, Dunsire Point, and Johnson Peak.

Access—An all-weather road runs southwest from Olney (which is on U.S. Highway No. 93, 18 miles north of

Whitefish) 4 miles to the northeast corner of the area, and another 10 miles through the area (along Good Creek) to the confluence of Alder Creek and Good Creek on the southwest border of the area. From the confluence, an improved gravel road runs for 3 miles north up the ridge between Alder Creek and Corduroy Creek (fig. 4-9).

The nearest railhead is at the small settlement of Olney, on the Burlington Northern rail line between Libby and Whitefish. For highway distances from Whitefish to various market centers in the United States, see table 1-2.

Terrain and Soil—As previously noted, the area lies between 3,800 and 5,800 feet elevation, with about two-thirds of the acreage having slopes less than 45 percent. Soils are glacial tills overlayed by up to 8 inches of volcanic ash (average about 4 inches); erosion potential is slight. Little exposed rock is evident and there are no special terrain obstacles.

Annual Precipitation and Duration of Snow-free Season—Annual precipitation totals about 35 inches, with 3 to 4 feet of snow accumulation common in midwinter. The snow-free season generally extends from about June 1 through October.

General Character of the Timber—Almost the entire area is thickly forested with lodgepole pine. Trees along Good Creek have a fair component of trees 6 to 8 inches in d.b.h., while those at higher elevation are mostly smaller than 6½ inches in d.b.h. Dead branch retention is not excessive, and there is relatively little down timber evident in the area (figs. 4-11 and 4-12).

Damage by mountain pine beetles is beginning to appear in spots (70 percent mortality in some stands in 1986), with predictions of 50 percent overall mortality in 10 years. Stem damage from porcupines and cankers is not evident. The most recent major forest fires in the area occurred in 1926. Trees are generally less than 100 years old.

No significant harvests have been made in the past, and none are planned for the immediate future.

Data on Sample Trees—A pair of codominants 3½ to 4 inches in d.b.h. were destructively sampled from level terrain at 4,700 feet elevation between Alder Creek and Corduroy Creek (fig. 4-12). Some pertinent tree characteristics follow. These tabulated data should not be interpreted as statistically representative of all trees.

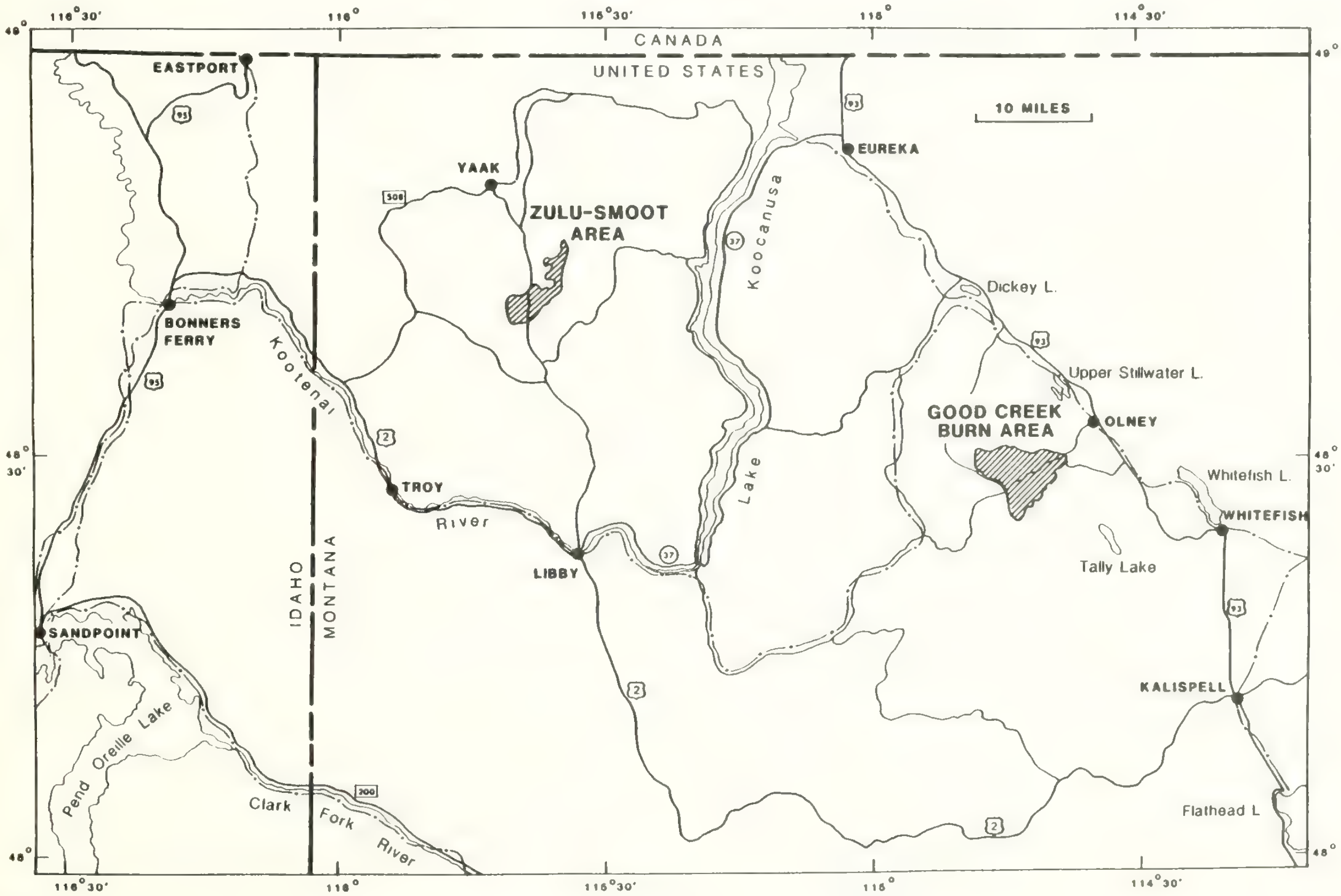

Figure 4-8—Vicinity map for the Good Creek Burn area of the Flathead National Forest and the Zulu-Smoot area of the Kootenai National Forest—both in Montana.

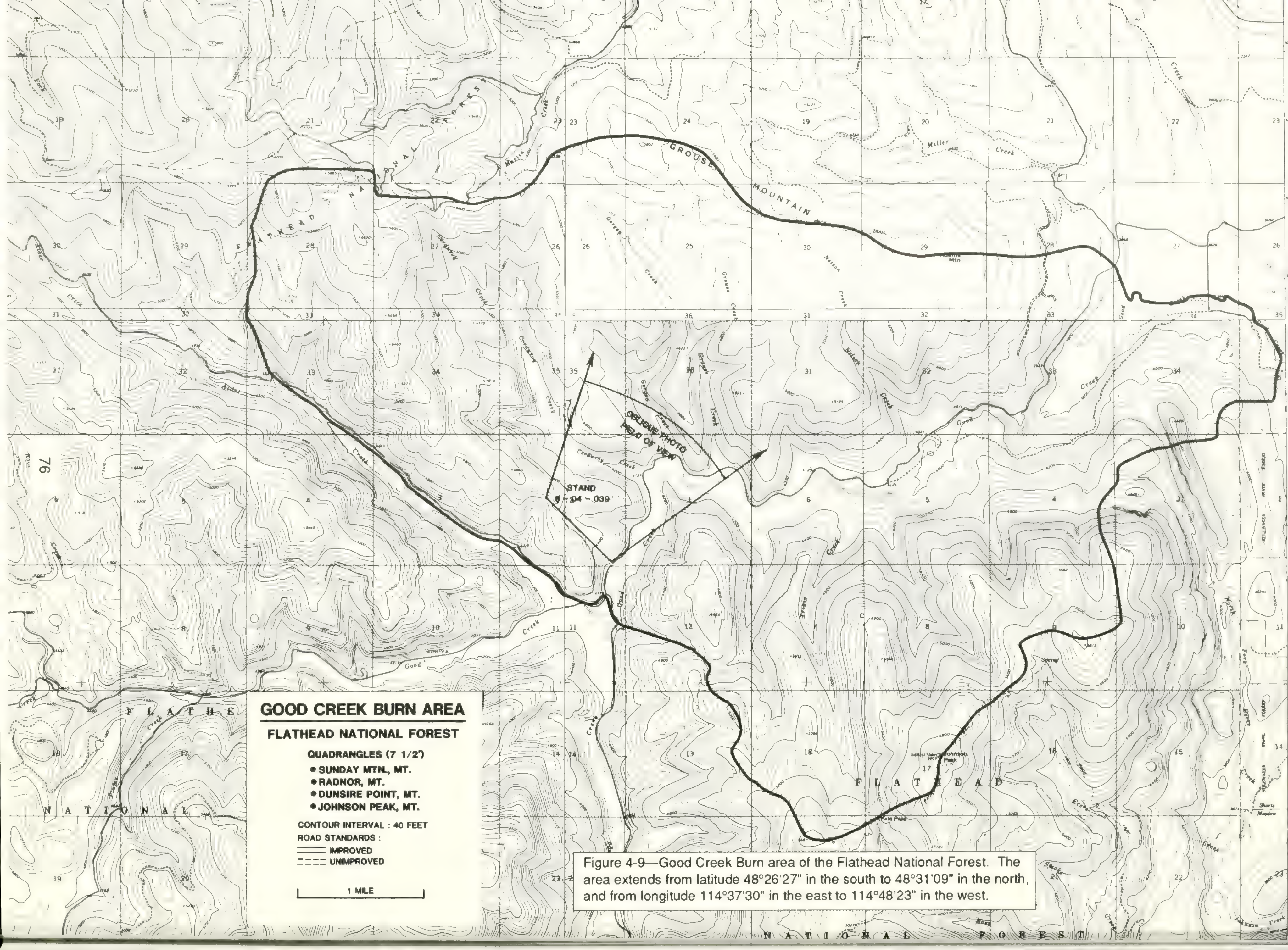

Figure 4-9—Good Creek Burn area of the Flathead National Forest. The area extends from latitude 48°26'27" in the south to 48°31'09" in the north, and from longitude 114°37'30" in the east to 114°48'23" in the west.

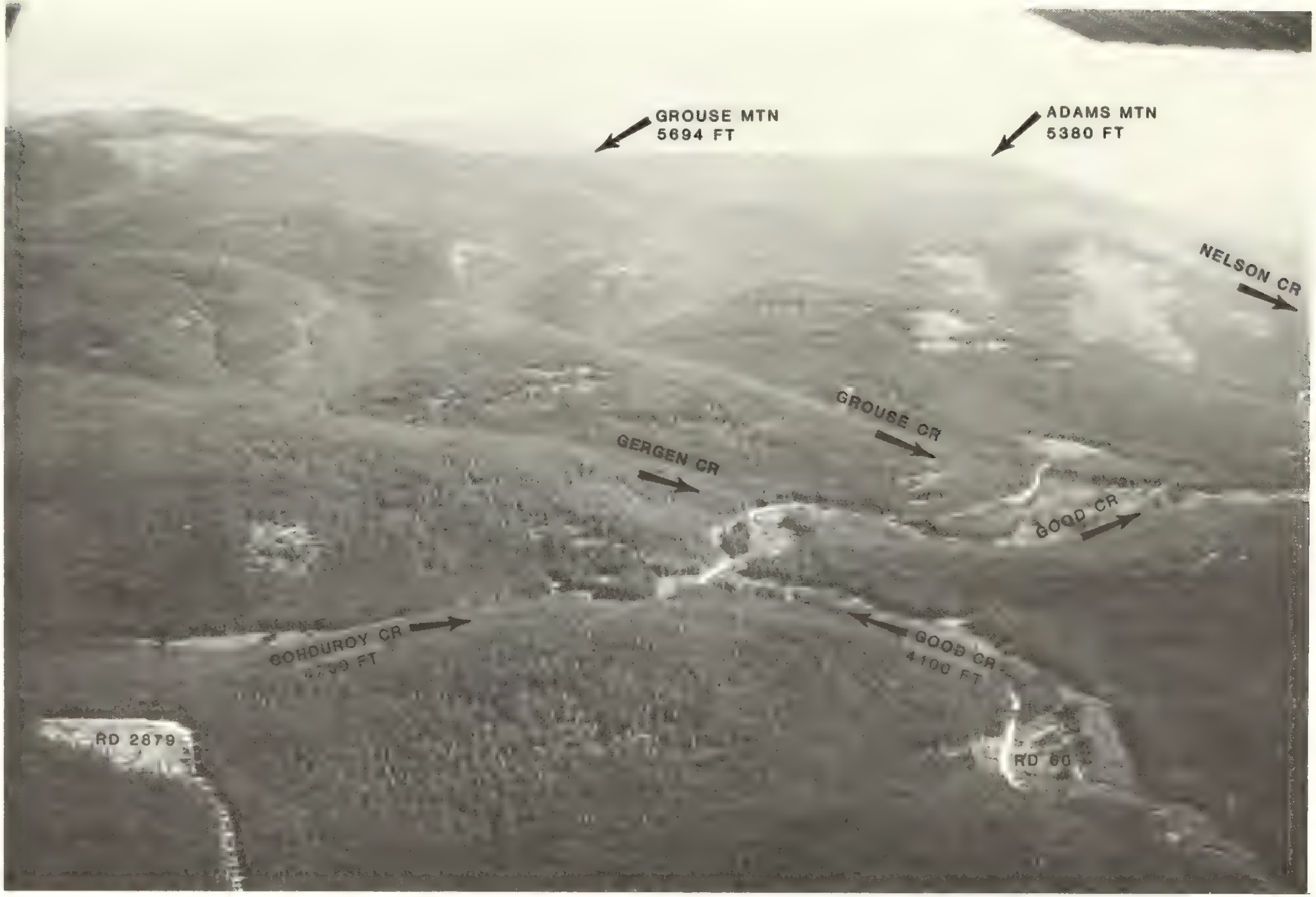

Figure 4-10—Oblique view of the Good Creek Burn area of the Flathead National Forest looking northeast from near confluence of Alder Creek and Gold Creek; see figure 4-9 for camera viewpoint and field of view. Width of foreground shown is about 1 mile; from foreground to Adams Mountain on the skyline in background is about 4 miles.

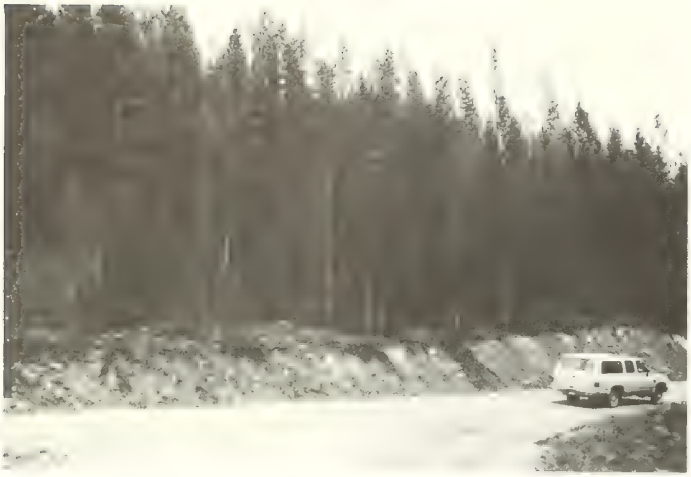

Figure 4-11—Pole stand at 4,200 feet near the confluence of Good Creek and Alder Creek along the main access road in the Good Creek Burn area of the Flathead National Forest.

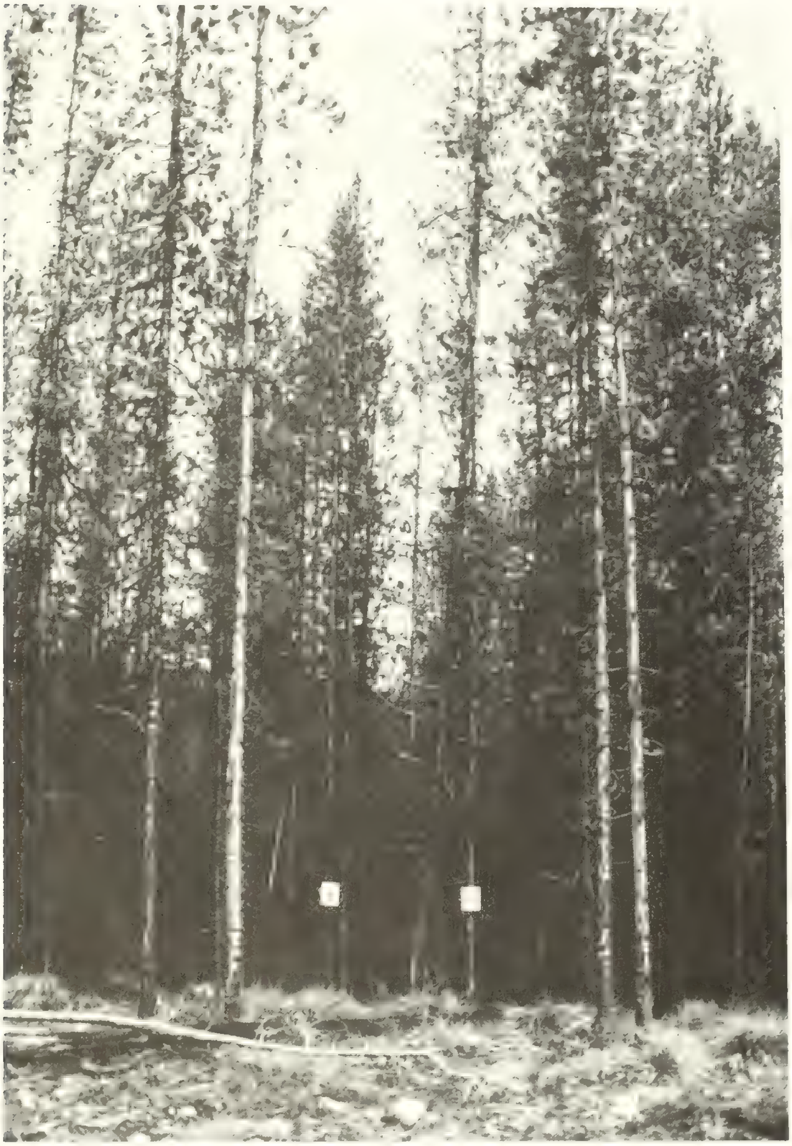

Figure 4-12—Pair of codominant lodgepole pines 3½ to 4 inches in d.b.h. sampled at 4,700 feet from level terrain between Alder Creek and Corduroy Creek in the Good Creek Burn area of the Flathead National Forest.

See appendix for an explanation of tree selection and procedures for evaluation of mechanical properties parallel to the grain at 10 percent moisture content.

Characteristic	Tree number 1	Tree number 2
D.b.h. (outside bark), inches	3.57	3.80
Tree height above 6-inch high stump, feet	33.0	39.6
Crown ratio, percent	50.8	58.3
Cone serotiny	- no data taken -	
Tree age years (number of annual growth rings)		
Stump height	70	72
20 percent of tree height	49	45
Base of live crown	34	35
Diameter inside bark, inches		
Stump height	3.67	3.79
20 percent of tree height	3.10	3.43
Base of live crown	2.42	2.93
Height from stump top to base of crown, inches	195	198
Stem taper inside bark, inches/100 inches		
Below crown	0.64	
Within crown	1.20	1.06
Rings/inch, average for section		
Stump height	38	38
Base of live crown	28	24
Properties of stemwood at 20 percent height		
Moisture content, percent ovendry weight	82.4	78.1
Specific gravity, ovendry weight and green volume	0.479	0.406
Rings/inch in first 1¼ inches radius	25	22
Ultimate compresssive strength, lb f/in²	6,460	5,910
Proportional limit, lb f/in²	4,550	4,530
Modulus of elasticity, lb f/in²	1,370,000	1,420,000
Compression wood evident?	none	none
Spiral grain angle at surface, degrees	2	1
Bark thickness (single), inch	0.15	0.10
Pith eccentricity, inch	0.2	0.1

Inventory Data—Inventory data are fairly complete for the area, and are available through the Tally Lake District office in Whitefish, MT. Most of the area carries pole stands, with trees 2 to 6 inches in d.b.h. predominating. Such stands are typified by stand 6-04-039, which is located within a few hundred yards of where the trees illustrated in figure 4-12 were sampled. Data (1981) for this 144-acre lodgepole pine stand are summarized as follows:

D.b.h. class *Inches*	Number of live trees per acre	Tree height *Feet*	Tree age *Years*
0-0.9	90	4	17
1.0-2.9	375	33	22
3.0-4.9	300	43	55
5.0-6.9	159	53	48
7.0-8.9	129	61	49
9.0-13.9	28	63	52
Total	1,081		

Additionally, the stand averaged 548 dead trees per acre.

Cubic Yield Potential and Height Growth—Managers responsible for the area estimate that it is capable of growing 75 to 100 ft³ of stemwood per acre per year in managed stands. Fifty-year height growth in managed stands is estimated to be about 50 feet.

Management Objectives for the Area and Constraints—A major management objective is phased harvest of existing stands and replacement with vigorous, controlled-density stands—not necessarily all lodgepole pine. Such new stands would be at less risk from mountain pine beetle attack than the present stands, and if harvests are timed appropriately, could enhance wildlife habitat and protect watershed and esthetic values.

The major obstacle to accomplishing this objective is lack of markets for subsawlog-size lodgepole pine.

Other Lodgepole Pine Available in the Area From Public Lands—It is estimated that an additional 10,000 acres of similar lodgepole pine stands are encompassed within the Flathead National Forest within a 50-air-mile radius of Kalispell.

Forest Products Industry in the Vicinity—At Olney, a large sawmill manufactures 2- by 4-inch studs and 1 by 3's and 4's from tree-length lodgepole pine with top diameters as small as 4 inches. Another large stud mill is located southeast of Eureka along U.S. Highway No. 93. A sawmill that manufactures random-length dimension lumber from a variety of species is located at Eureka, and another by Upper Stillwater Lake. Columbia Falls, a few miles east of Whitefish, is a major center for forest products manufacturing. Also, a post-and-pole plant operates in Kalispell, 13 miles south of Whitefish. The nearest pulp mill is near Missoula, about 120 highway miles south of Whitefish.

Population in the Vicinity—In 1984 Flathead County had a total population of 53,900, with 11,000 residing within the town limits of Kalispell, the county seat (26,000 in greater Kalispell). In 1980 Whitefish had a population of 3,749 within urban city limits, and about 7,000 in greater Whitefish.

Per-capita income in Flathead County averaged $10,874 in 1984; 11.0 percent of the workforce was unemployed in February 1986.

GALLATIN NATIONAL FOREST

Area Name and Location—The Goose-Levinski area (figs. 4-13, 4-14, and 4-15), which lies at an elevation of 5,800 to 9,800 feet at latitude 45°16' and longitude 111°12', is in the Bozeman Ranger District of the Gallatin National Forest; the Ranger Station is in Bozeman.

The gross area of about 7,000 acres includes about 5,000 acres of lodgepole pine timber type and falls entirely within Gallatin County; Bozeman is the county seat. The area is centered on Goose and Levinski Creeks immediately southeast of the Gallatin River (adjoining the river), and is due east across the main Gallatin River from its confluence with the West Fork. From Bozeman the area is 30 air miles south-southwest on a heading of 200°.

Maps of the Area—USGS quadrangle 15' maps needed to depict the area are: Spanish Peaks, MT; Garnet Mountain, MT; Sphinx Mountain, MT; and Crown Butte, MT-WY.

Access—U.S. Highway No. 191 runs 37 miles south-southwest to the confluence of Portal Creek with the Gallatin River, and another 6 miles along the area's northwest boundary to the Gallatin River confluence with the West Fork on the westernmost edge of the area. A good gravel road extends up Portal Creek a few miles and then an unimproved dirt road (10 miles from the Portal Creek-Gallatin River confluence) reaches 7,500 feet elevation on the divide between Hidden Creek and Portal Creek; from whence the dirt road leads to Hidden Creek and west to the area boundary at about 8,200 feet (fig. 4-14). Narrow strips of private land just southeast of the Gallatin River lie between U.S. Highway No. 191 and much of the area's northwest boundary.

The nearest railhead is Bozeman, or equally distant Belgrade, both on the Burlington Northern line (fig. 4-13). For highway distances from Bozeman to various market centers in the United States, see table 1-2.

Terrain and Soil—As previously noted, the area lies between 5,800 and 9,800 feet elevation, but most of the timber lies below 8,000 feet. Most of the timbered acreage has slopes in excess of 45 percent. Soils are moderately coarse in texture with significant rock outcroppings (up to 40 percent). These outcroppings, together with the steep slopes, are the major physical obstacles to harvesting.

Annual Precipitation and Duration of Snow-free Season—Annual precipitation totals 30 to 50 inches, with 2 or 3 feet of snow accumulation common in winter. The snow-free season generally extends from June 1 through October.

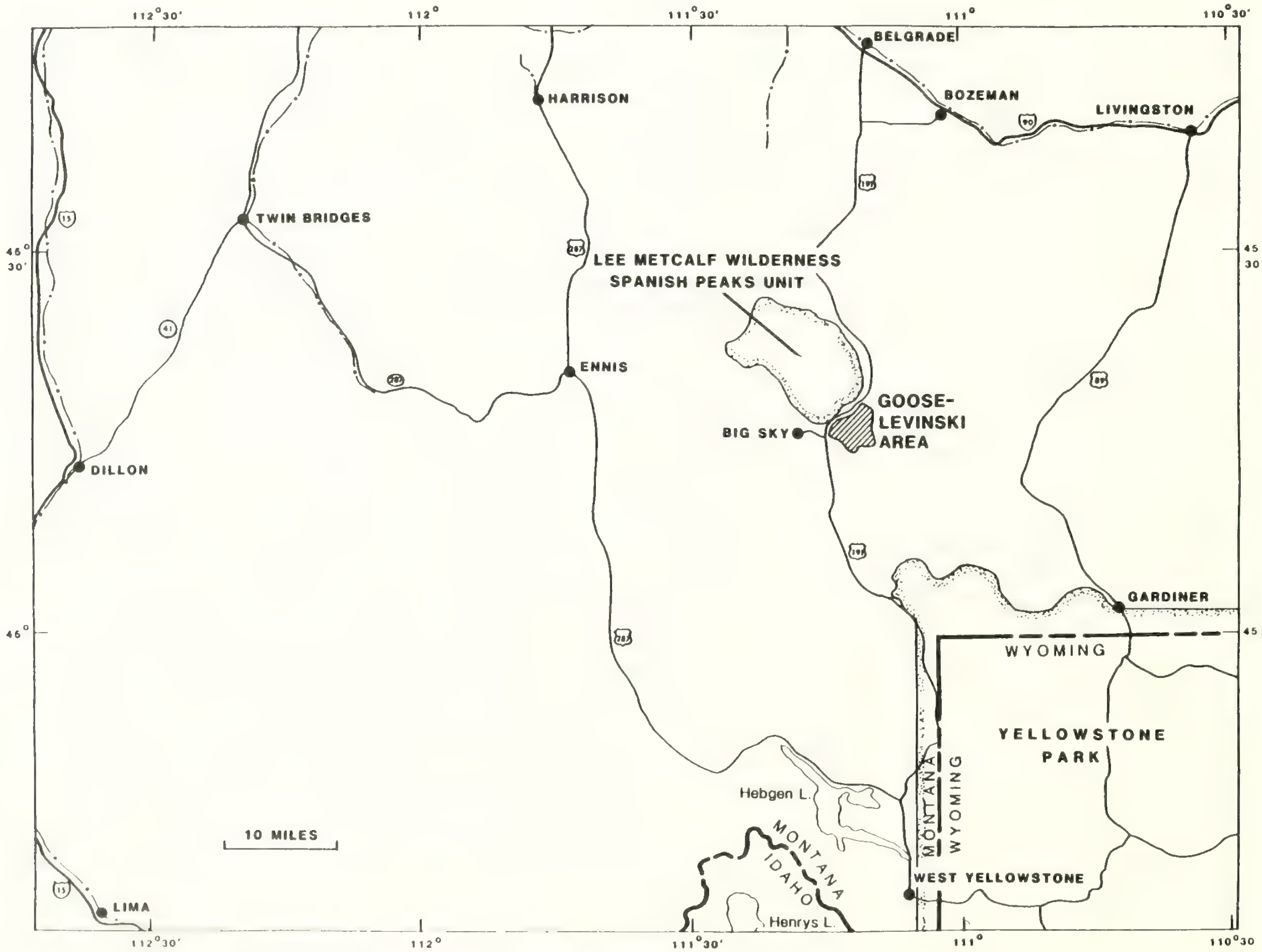

Figure 4-13—Vicinity map for the Goose-Levinski area of the Gallatin National Forest in Montana.

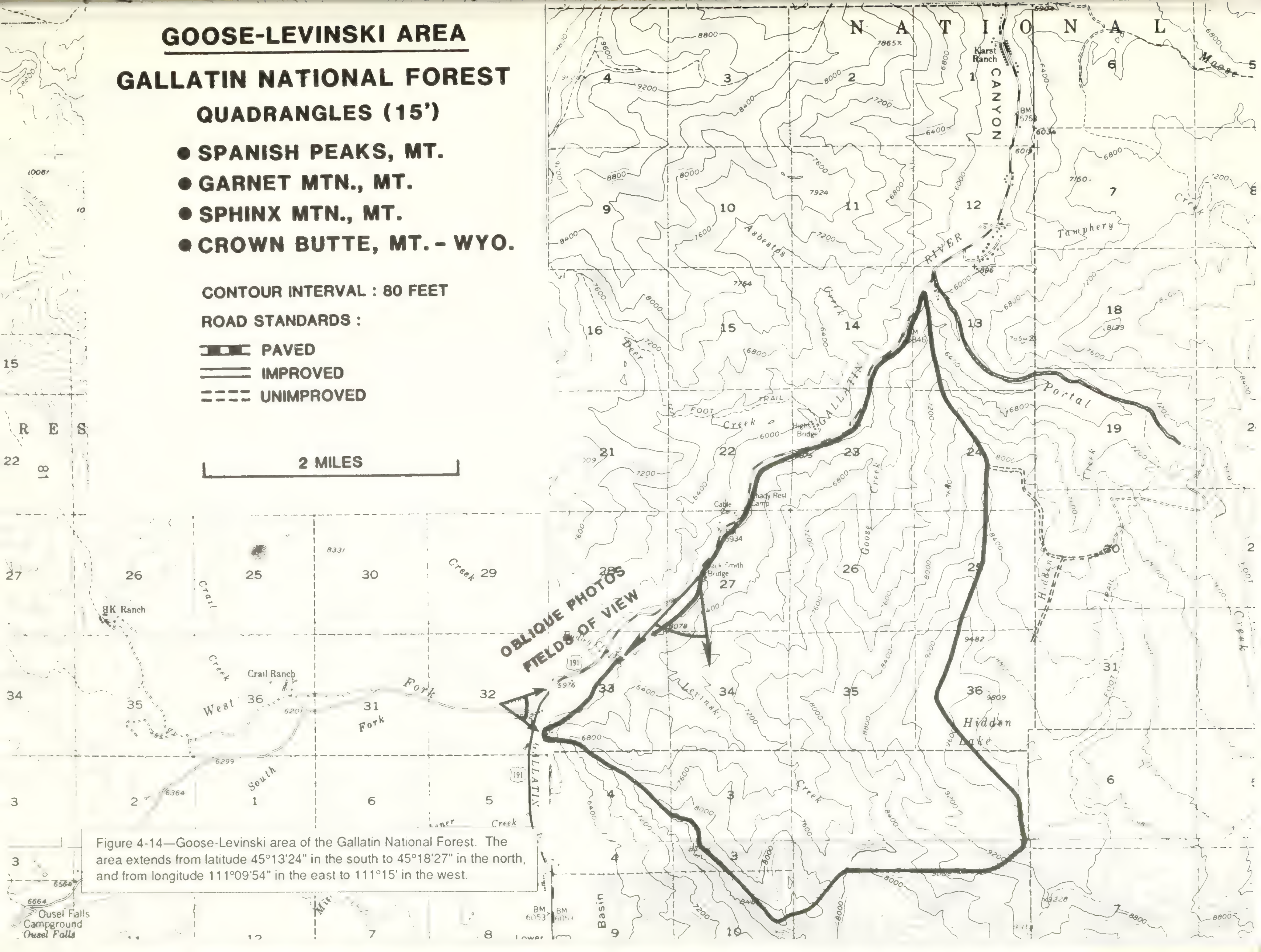

Figure 4-14—Goose-Levinski area of the Gallatin National Forest. The area extends from latitude 45°13'24" in the south to 45°18'27" in the north, and from longitude 111°09'54" in the east to 111°15' in the west.

General Character of the Timber—The lodgepole pine trees are predominantly 1 to 7 inches in d.b.h. (table 4-3). Although a significant proportion of the trees (up to 50 percent) are dead from mountain pine beetle attack, there is not yet excessive down timber. Also, significant numbers of trees have cankers on lower stem sections (fig. 4-16).

The last major forest fires in the area were in the 1880's. There has been virtually no harvesting in the area, and none is planned in the immediate future.

Data on Sample Trees—A pair of codominant lodgepole pines 3½ to 4 inches in d.b.h. were destructively sampled just south of Levinski Creek at 6,400 feet elevation (fig. 4-17). Some pertinent tree characteristics follow. These tabulated data should not be interpreted as statistically representative of all trees.

See appendix for an explanation of tree selection and procedures for evaluation of mechanical properties in compression parallel to the grain at 10 percent moisture content.

Characteristic	Tree number 1	Tree number 2
D.b.h. (outside bark), inches	3.80	3.55
Tree height above 6-inch high stump, feet	45.0	36.0
Crown ratio, percent	49	26
Cone serotiny	- - no data taken - -	
Tree age years (number of annual growth rings)		
Stump height	96	89
20 percent of tree height	46	67
Base of live crown	37	39
Diameter inside bark, inches		
Stump height	3.82	3.68
20 percent of tree height	3.37	3.18
Base of live crown	2.20	2.17
Height from stump top to base of live crown, inches	276	318
Stem taper inside bark, inches/100 inches		
Below crown	0.59	0.47
Within crown	0.83	1.90
Rings/inch, average for section		
Stump height	52	47
Base of live crown	32	36
Properties of stemwood at 20 percent height		
Moisture content, percent ovendry weight	80.0	82.2
Specific gravity, ovendry weight and green volume	0.456	0.471
Rings/inch in first 1¼ inches radius	37	40
Ultimate compresssive strength, lb f/in^2	7,900	8,700
Proportional limit, lb f/in^2	6,080	5,220
Modulus of elasticity, lb f/in^2	1,570,000	1,800,000
Compression wood evident?	none	none
Spiral grain angle at surface, degrees	2	2
Bark thickness (single), inch	0.12	0.12
Pith eccentricity, inch	0.1	0.2

Inventory Data—Stand examination data are available at the Bozeman Ranger District office for most of the area below 8,000 feet. Data summarized from several of the lodgepole pine stands having acreage in excess of 80 acres (table 4-3) suggest that stands may typically have 1,100 or 1,200 trees per acre larger than 1.0 inch in d.b.h., and that a little more than half these trees measure 1.0 to 2.9 inches in d.b.h., about one-third 3.0 to 4.9 inches, one-tenth 5.0 to 6.9 inches, and less than one-tenth larger than 7 inches in d.b.h.

Cubic Yield Potential and Height Growth—Managers responsible for the area estimate that present growth of stemwood in the area is about 25 ft^3 per acre per year. Fifty-year height growth in managed stands is estimated at 55 to 60 feet.

Management Objectives for the Area and Constraints—Because the site is relatively good for lodgepole pine, and because the risk of mortality from fire and mountain pine beetle is high, managers of the area would like to see a phased replacement of decadent stands with vigorous, new, controlled-density lodgepole stands. But small stem size, very steep and rocky terrain, difficult access, high proportion of dead volume, and high visibility of the area from the Gallatin River corridor leading to Yellowstone Park, make it improbable that any harvest other than small-scale experimental harvests for research purposes will be conducted in the area in the foreseeable future.

Other Lodgepole Pine Available in the Area From Public Lands—Managers of the Gallatin National Forest believe that milling capacity in the area now exceeds scheduled yield from the forest, so additional acreage is probably not available for additional mills—even those designed to utilize trees of subsawlog diameters.

Forest Products Industry in the Vicinity—In the extended vicinity there are two large mills manufacturing 2- by 4-inch studs—one in Belgrade and one in Livingston. Additionally, sawmills that manufacture random-length dimension lumber are located in Livingston and a few miles southwest of Bozeman. Lodgepole pine roundwood manufacturers include post-and-pole operations in Belgrade and Bozeman, and three manufacturers of house logs southwest of Bozeman.

Population in the Vicinity—Gallatin County has a total population (1986) of 46,183; the population of the town of Bozeman is 25,050. Per-capita income in Gallatin County averaged $8,737 in 1982. In 1986, 6.9 percent of the workforce in Gallatin County was unemployed.

HELENA NATIONAL FOREST

Area Name and Location—The Poorman Creek area (figs. 4-2, 4-18, and 4-19), which lies at an elevation of 4,600 to 7,600 feet at latitude 46°52' and longitude 112°34', is in the Lincoln Ranger District of the Helena National Forest; the Ranger Station is in Lincoln.

Table 4-3—Stand table data for five lodgepole pine stands 81 acres or larger in the Goose-Levinski area of the Gallatin National Forest; live trees only larger than 1 inch. The letter "S" behind the number of trees per acre denotes spruce rather than lodgepole pine

D.b.h. class, inches, and statistic	Stand number (and acres)				
	01012 (139)	01018 (84)	02002 (86)	02010 (127)	03059 (81)
1.0-2.9					
Number of trees/acre	925	75	935	880	225
Tree height, feet	25	20	25	30	14
3.0-4.9					
Number of trees/acre	525	325	525	400	75
Tree height, feet	38	32	38	41	37
5.0-6.9					
Number of trees/acre	123	93	123	206	16
Tree height, feet	43	40	43	51	50
7.0-8.9					
Number of trees/acre	40	74	40	62	38
Tree height, feet	63	49	63	57	55
9.0-13.9					
Number of trees/acre	40S	0	20S	8S	21
Tree height, feet	75	—	75	71	65

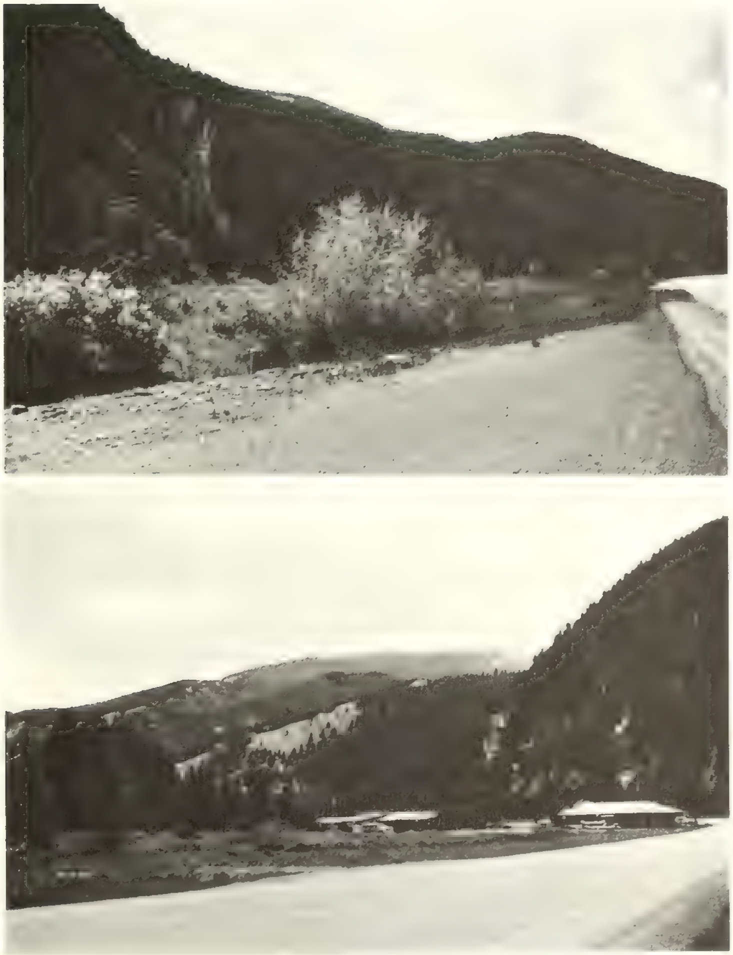

Figure 4-15—Goose-Levinski area of the Gallatin National Forest viewed from near the Jack Smith Bridge on U.S. Highway No. 191 (top), and from near the highway junction to Big Sky resort (bottom). See figure 4-14 for photo viewpoints.

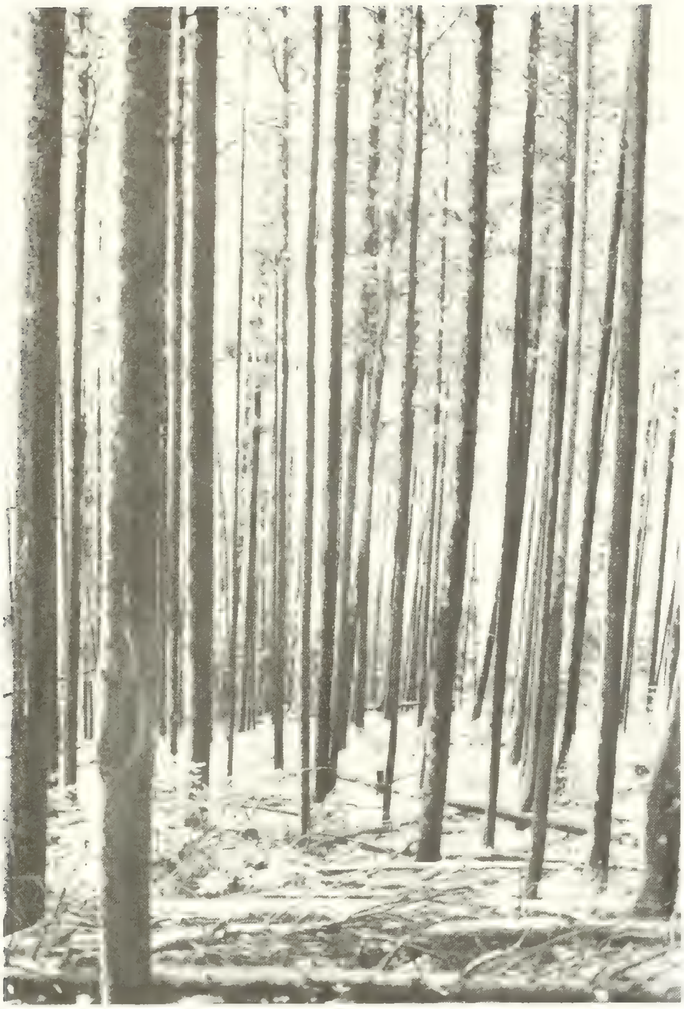

Figure 4-16—Lodgepole pines on southwest-facing slope at 6,400 feet just south of Levinski Creek in the Gallatin National Forest. Cankers are visible on lower stems of foreground trees at right and left. About half the trees have been bark-beetle killed.

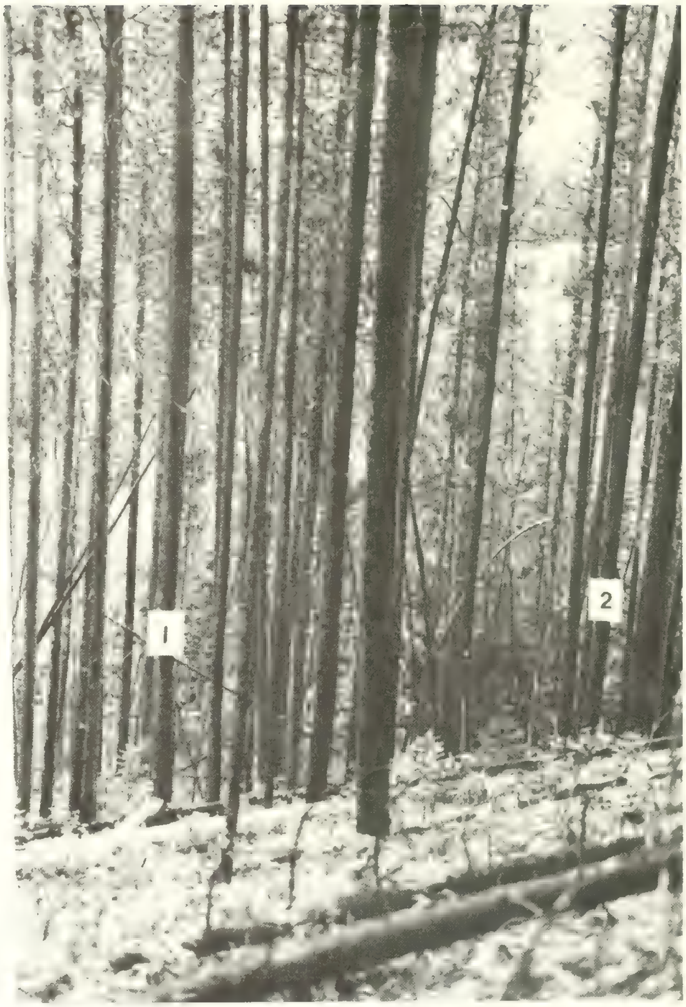

Figure 4-17—Pair of codominant lodgepole pines $3^1/_2$ to 4 inches in d.b.h. sampled just south of Levinski Creek at 6,400 feet elevation.

The gross area of 25,000 acres includes about 8,300 acres of lodgepole pine timber stands and falls mostly within Lewis and Clark County (fig. 4-18); Helena is the county seat. The southeast corner of the area extends into Powell County, of which Deer Lodge is the county seat.

Maps of the Area—USGS quadrangle $7^1/_2$' maps needed to depict the area are: Finn, Granite Butte, Lincoln, Nevada Mountain, Stemple Pass, and Swede Gulch.

Access—The more-or-less rectangular area lies immediately west of the Continental Divide. Accessibility to the bottoms of some of the major drainages is complicated by the presence of mining claims (fig. 4-18).

An all-weather gravel road runs from Lincoln (elevation about 4,500 feet) south about 3 miles to the north border of the area, and then east up Poorman Creek (which bisects the area) to Stemple Pass, which is 16 highway miles distant from Lincoln at an elevation of 6,200 feet on the Continental Divide (fig. 4-18). A dirt loop road runs south from Stemple Pass and then down the South Fork of Poorman Creek. Additional dirt roads extend short distances into the northern half of the area.

The all-weather road extends 42 miles southwest beyond Stemple Pass to the railhead town of Helena (elevation about 3,800 feet). Slightly more distant to the south and southwest are the railheads at Avon, Garrison, and Drummond (fig. 4-2). For highway distances from Helena to various market centers in the United States, see table 1-2.

Terrain and Soil—As previously noted, the area lies between 4,600 and 7,600 feet elevation, with about half of the area having slopes in excess of 45 percent (fig. 4-19). Soils are not excessively stony, and they present no special obstacles to road building. Grassy openings in the timber are features of that portion of the area north of Poorman Creek.

Annual Precipitation and Duration of Snow-free Season—Annual precipitation totals about 20 inches, most of which falls as snow. The snow-free season generally extends from early June through late October.

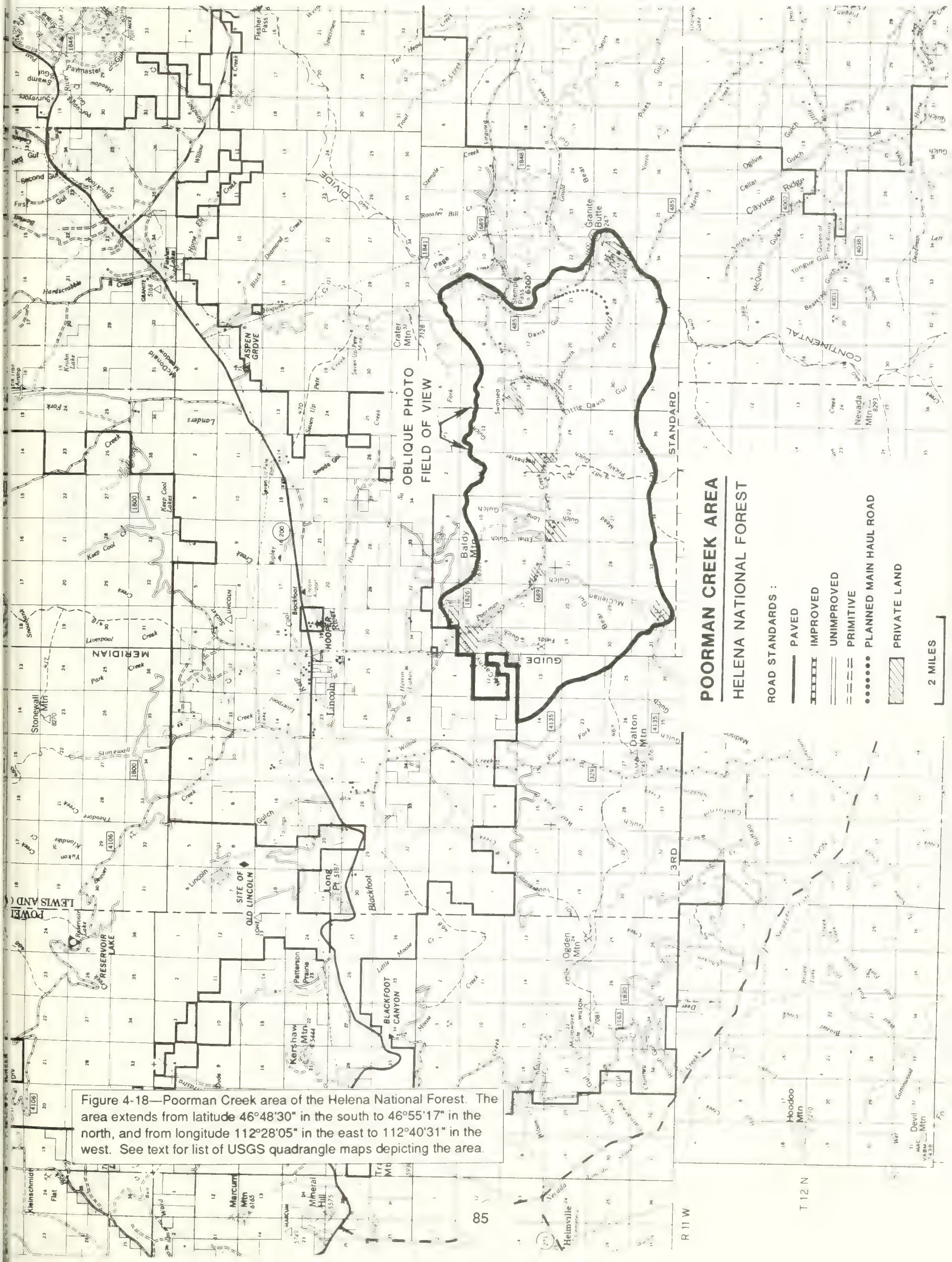

Figure 4-18—Poorman Creek area of the Helena National Forest. The area extends from latitude 46°48'30" in the south to 46°55'17" in the north, and from longitude 112°28'05" in the east to 112°40'31" in the west. See text for list of USGS quadrangle maps depicting the area.

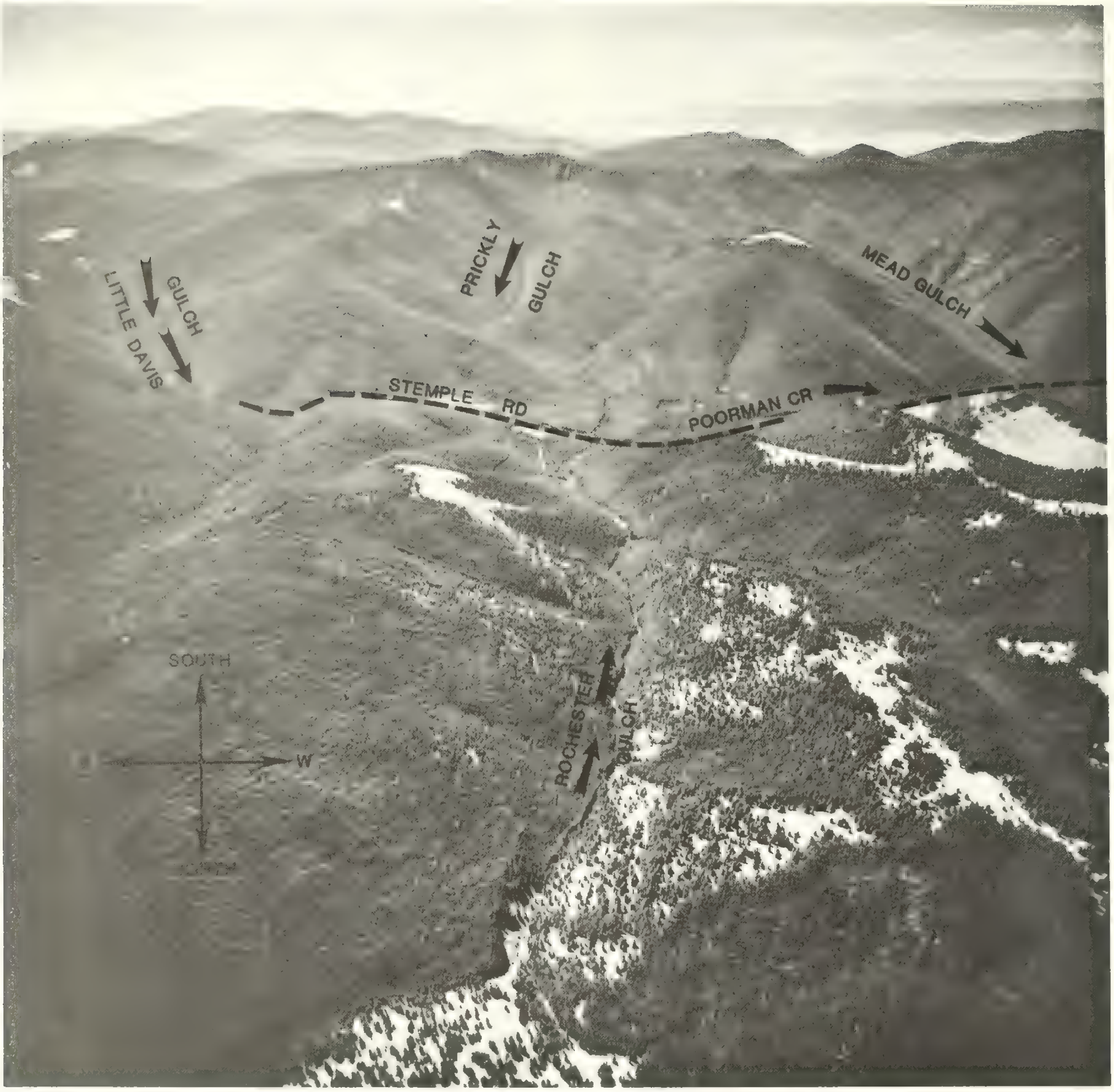

Figure 4-19—Oblique view of the Poorman Creek area of the Helena National Forest looking west from the head of Rochester Gulch; see figure 4-18 for camera viewpoint and field. The area illustrated is about 4 miles across, and 5 miles from foreground to low background. About 90 percent of the area is timbered.

General Character of the Timber—The timbered area is virtually all lodgepole pine type, but has a significant Douglas-fir component. Stands grade in a continuum from small pole stands (fig. 4-20) into dense thickets of very small stagnated stems (fig. 4-21), and into small sawtimber.

The small sawtimber may have red heart fungal infections in the heartwood. Stem crook, stem cankers, and porcupine damage are all evident in many of the pole stands (fig. 4-22). Mortality from mountain pine beetle is not evident, and the forest floor is comparatively clear of down timber. Most of the stands have moderate to heavy dwarf mistletoe infestations.

Most of the acreage was burned during the peak of mining activity from 1860 to 1900. In recent years there has been little harvest activity, but significant harvests are planned for the next decade.

Data on Sample Trees—A pair of codominant lodgepole pines $3^1/_2$ to 4 inches in d.b.h. were destructively sampled just south of Stemple Pass from gently sloping ground at 6,200 feet elevation (fig. 4-20). Some pertinent tree characteristics follow. These tabulated data should not be interpreted as statistically representative of all trees.

See appendix for an explanation of tree selection and procedures for evaluation of mechanical properties in compression parallel to the grain at 10 percent moisture content.

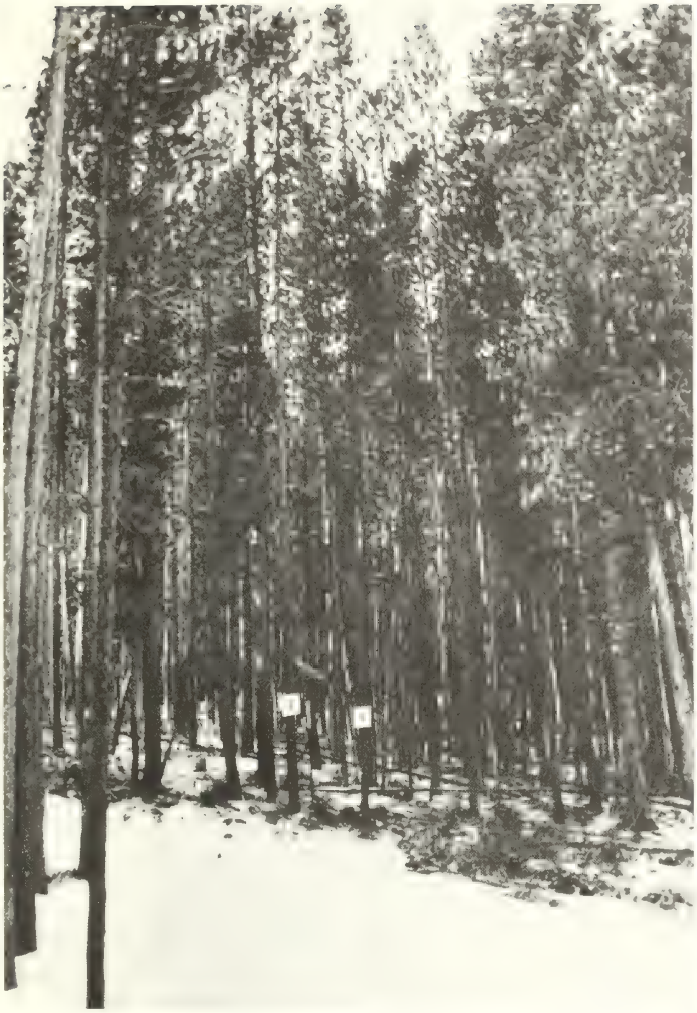

Figure 4-20—Pair of codominant lodgepole pines 3½ to 4 inches in d.b.h. sampled from gently sloping terrain just south of Stemple Pass at an elevation of about 6,200 feet.

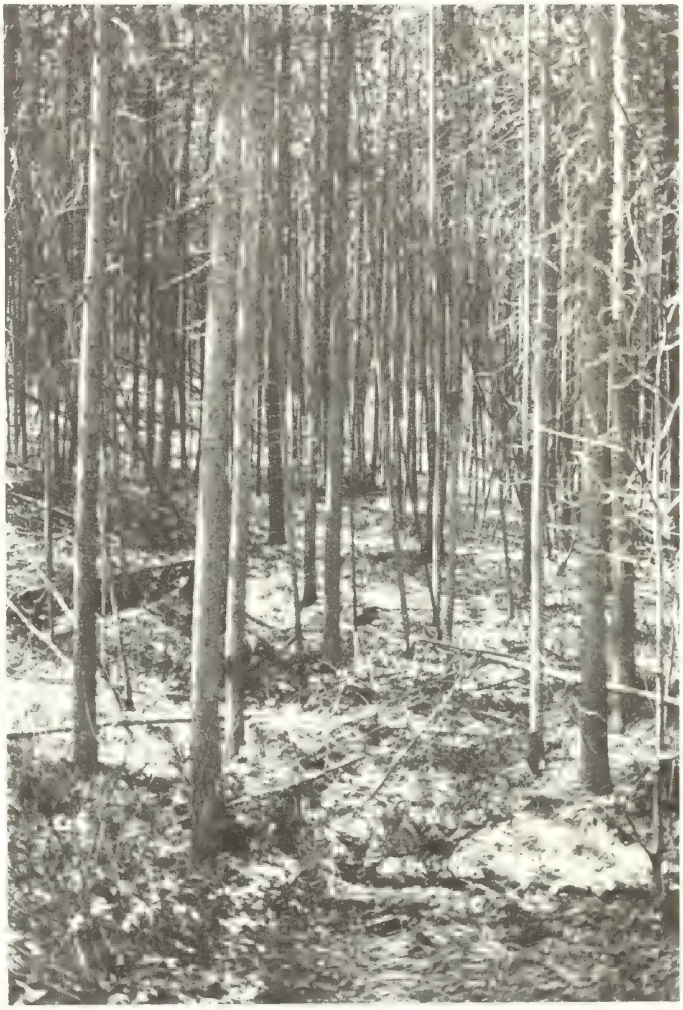

Figure 4-21—Densely stocked, stagnated stand of lodgepole pines—almost all less than 3 inches in d.b.h.—in the Poorman Creek area of the Helena National Forest. The stadia rod in the center of the photo has 1-foot markings.

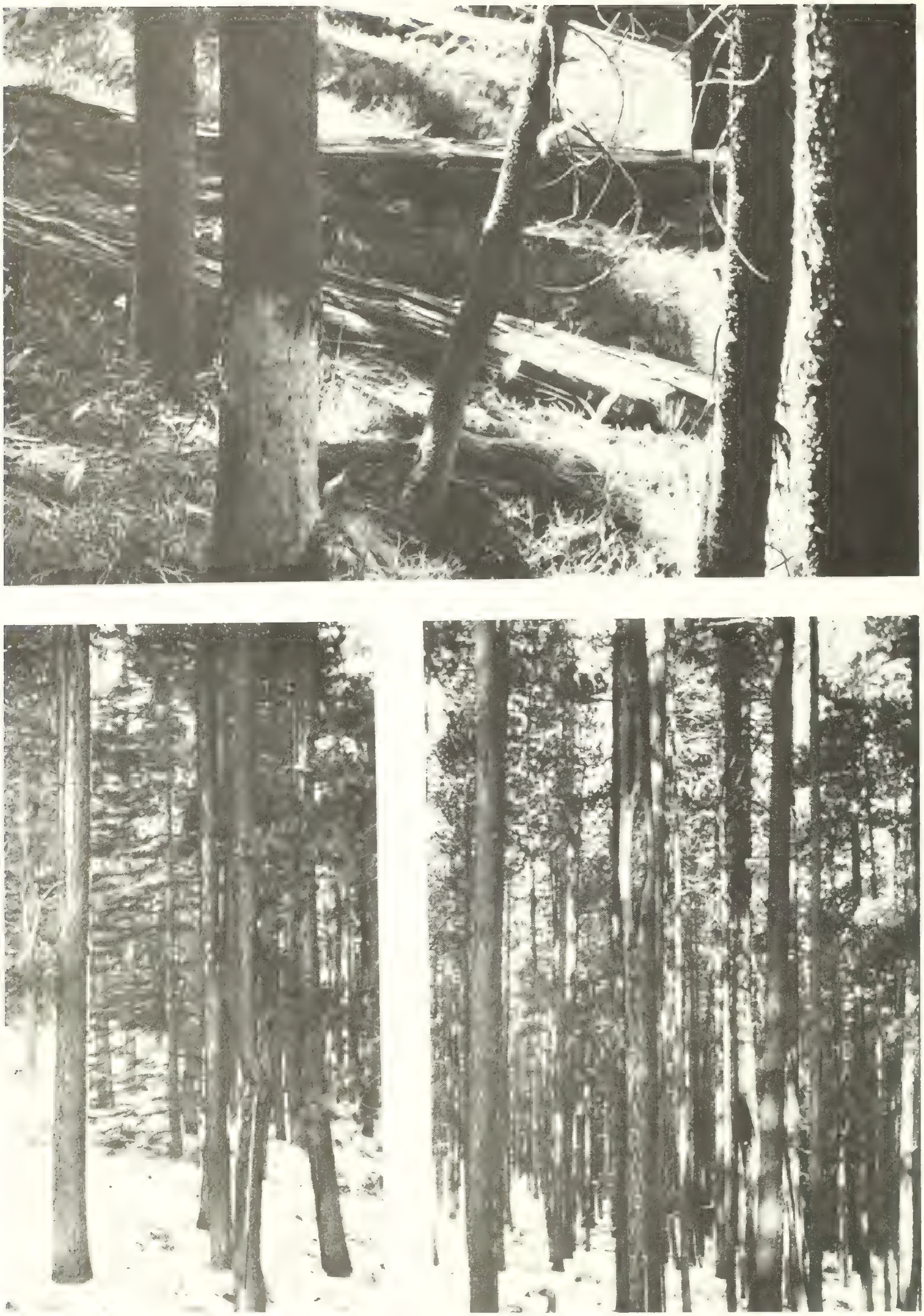

Figure 4-22—Typical defects of lodgepole pines observed in the Poorman Creek area of the Helena National Forest. (Top) Porcupine damage at butt of stem. (Bottom left) Stem crook; the stadia rod has 1-foot markings. (Bottom right) Stem cankers.

Characteristic	Tree number 1	Tree number 2
D.b.h. (outside bark), inches	3.70	4.0
Tree height above 6-inch high stump, feet	28.0	34.8
Crown ratio, percent	38.1	25.4
Cone serotiny	no observation	
Tree age years (number of annual growth rings)		
Stump height	98	93
20 percent of tree height	74	76
Base of live crown	56	33
Diameter inside bark, inches		
Stump height	3.80	4.25
20 percent of tree height	3.18	3.55
Base of live crown	2.38	2.05
Height from stump top to base of crown, inches	208	312
Stem taper inside bark, inches/100 inches		
Below crown	0.68	0.71
Within crown	1.86	1.93
Rings/inch, average for section		
Stump height	52	44
Base of live crown	47	32
Properties of stemwood at 20 percent height		
Moisture content, percent ovendry weight	95.9	103.4
Specific gravity, ovendry weight and green volume	0.432	0.423
Rings/inch in first 1¼ inches radius	42	32
Maximum crushing strength, lb f/in^2	5,990	7,240
Proportional limit, lb f/in^2	4,590	5,300
Modulus of elasticity, lb f/in^2	1,350,000	1,860,000
Compression wood evident?	none	none
Spiral grain angle at surface, degrees	0	1
Bark thickness (single), inch	0.11	0.14
Pith eccentricity, inch	0.2	0.5

Inventory Data—The entire area has been type mapped, and the lodgepole timber stands classified as type 1 (22 percent of the 8,300 acres of lodgepole pine), type 2 (72 percent of the 8,300 acres), and type 3 (6 percent of the 8,300 acres), with accompanying inventories based on 35, 40, and 25 plots, respectively (table 4-4). Type 1 is predominantly sapling size trees, often in overstocked "doghair" stands; type 2 is small to medium pole size class material; and type 3 is large pole and small sawtimber size class. Live lodgepole stems larger than 2.9 inches in d.b.h. numbered 1,375, 930, and 396 stems per acre for stand types 1, 2, and 3, respectively.

In addition to the live lodgepole stems enumerated in table 4-4, the three types of stands had other stems larger than 2.9 inches in d.b.h. as follows:

Table 4-4—Diameter and height distribution of live trees for three major stand types of lodgepole pine in the Poorman Creek area of the Helena National Forest[1]

D.b.h. class, inches, and statistics	Stand type 1	Stand type 2	Stand type 3
0-2.9			
Number of trees/acre	3,109	915	40
Tree height, feet	—	—	—
3.0-3.9			
Number of trees/acre	706	320	20
Tree height, feet	33.6	33.7	24.2
4.0-4.9			
Number of trees/acre	383	202	32
Tree height, feet	40.0	41.5	38.3
5.0-5.9			
Number of trees/acre	169	123	36
Tree height, feet	43.7	49.5	41.7
6.0-6.9			
Number of trees/acre	91	115	104
Tree height, feet	48.9	50.9	44.3
7.0+			
Number of trees/acre	26	170	204
Tree height, feet	48.9	60.6	49.4
Total live trees/acre	4,484	1,845	436

[1] **Stand type 1** = lodgepole pine saplings. Preponderance of stems smaller than 3 inches d.b.h. with limited representation of stems 5 inches and larger. **Stand type 2** = lodgepole pine poles. Approximately half the stems smaller than 3 inches d.b.h. with substantial representation of stems in the 4-, 5-, and 6-inch classes. **Stand type 3** = lodgepole pine poles. Few stems smaller than 4 inches d.b.h. with major representation of stems in the 6- and 7-inch classes.

Stand type	Dead lodgepole	Other species
	- - - Trees per acre - - -	
1	49	15
2	71	90
3	44	84

Although table 4-4 and the foregoing percentages of each of the three types tabulated are sufficient to convey a general idea of the inventory, a more detailed report has been prepared for the Intermountain Research Station (Hawkins 1987). The detailed report contains information for each stand type on percent slope, aspect, diameter at the base of the crown, rings per inch, cubic feet of stem volume per acre, dead-tree statistics, associated species, and prevalence and kind of defect.

Cubic Yield Potential and Height Growth—Although data are not well documented, managers of the area estimate that growth potential for managed lodgepole pine stands is 70 to 80 ft^3 per acre per year. Fifty-year height growth in managed stands is estimated at 50 feet.

Management Objectives for the Area and Constraints—Much of the area is visible from the Continental Divide Trail; harvest activities in the area, therefore, must not excessively disrupt visual quality of landscapes in view of the trail. The area is also good elk habitat—a value that must be enhanced. Also, watershed value must be preserved.

With the foregoing qualifications, the managers of the area would like to accomplish a phased replacement of the present stagnated stands with vigorous, new, controlled-density lodgepole stands.

Other Lodgepole Pine Available in the Area From Public Lands—In addition to the 8,300 acres of lodgepole pine in the Poorman Creek area, the Helena National Forest has an additional 10,000 acres of similar lodgepole pine timber type for which there is little market.

Forest Products Industry in the Vicinity—A large post-and-pole operation is located just east of Lincoln in close proximity to the area. Other more distant (and smaller) post-and-pole operations include three located in the Drummond-Hall-Philipsburg area, one in Deer Lodge, one near Avon, and one south of Helena. Sawmills manufacturing 2- by 4-inch studs operate in Deer Lodge, Drummond, and Hall. The Missoula area, 84 highway miles west of Lincoln, has several sawmills, a plywood plant, a particleboard plant, and a kraft pulp mill.

Population in the Vicinity—In 1984 Lewis and Clark County had a total population of 45,800. Helena, the county seat, had a population of 23,938 in 1980. Population in Lincoln and the surrounding area is about 800. In July 1986, 6.8 percent of those in the workforce in the county were unemployed. Annual per-capita income in Lewis and Clark County was $12,270 in 1984.

KOOTENAI NATIONAL FOREST

Area Name and Location—The Zulu-Smoot area (figs. 4-8, 4-23, and 4-24), which lies at an elevation of 3,700 to 6,500 feet at latitude 48°43' and longitude 115°35', is in the Yaak Ranger District of the Kootenai National Forest; the Ranger Station is 18 miles north of Troy.

The gross area of about 5,000 acres includes about 4,200 acres of lodgepole pine timber type and falls entirely within Lincoln County; Libby is the county seat. The area is centered in the Zulu and Smoot Creek drainages immediately east of State Highway No. 506; it lies 10 air miles south-southeast of Yaak on a heading of 155° and 22 air miles north-northwest of Libby on a heading of 350°.

Maps of the Area—USGS quadrangle 7$^1/_2$' maps needed to depict the area are: Yaak, Lost Horse Mountain, Flatiron Mountain, and Pink Mountain.

Access—All-weather State Highway No. 506 between Libby and Yaak lies within the area, and parallels its western border. Except for the northeast corner of the area, where a Forest Service road bisects the timber body, other quadrants of the area have roads only to perimeters (fig. 4-23).

The nearest railhead is Libby (Burlington Northern), 25 highway miles distant, at an elevation of about 2,000 feet. Moyie Springs, ID, 43 miles northwest of Libby, is a railhead on the Union Pacific line. For highway distances from Libby to various market centers in the United States, see table 1-2.

Terrain and Soil—As previously noted, the area lies between 3,700 and 6,500 feet elevation, with about four-fifths of the acreage having slopes less than 45 percent. Soils are comprised of 10 to 12 inches of volcanic ash overlaying glacial till. There are no special terrain obstacles to harvesting (fig. 4-24) except for some rock outcroppings at the uppermost elevations.

Annual Precipitation and Duration of Snow-free Season—Annual precipitation totals about 35 inches. The snow-free season generally extends from about mid-April to mid-November.

General Character of the Timber—Analysis of 10 stands of lodgepole pine timber type in the area suggests that the average acre has about 1,679 live trees, of which 1,270 are lodgepole pine. Of these 1,270 trees, which average 4.7 inches in d.b.h. and 48 feet in height, 402 measure less than 3 inches in d.b.h. Considerable dead timber is on the ground or in the slow process of falling to the ground (fig. 4-25). Trees are generally about 65 years old, dating from a major forest fire in 1920.

About 28 percent of the live lodgepole trees in the five stands for which data are in hand have some kind of stem damage—mostly multiple, deep scars resulting from disease and animal activity (fig. 4-26). The overall stem-damage rate may well be higher than indicated by these five stands.

Mortality from mountain pine beetle is not expected to be a problem in the area.

There have been no significant commercial harvests in the area, but in an effort to rehabilitate the forest, 170 acres were bulldozed and piled in 1984, and burned and planted in 1986; another 37 acres were trampled in 1986 (fig. 4-24).

Data on Sample Trees—A pair of adjacent 3$^1/_2$- to 4-inch codominants growing at 4,200 feet on a gentle slope

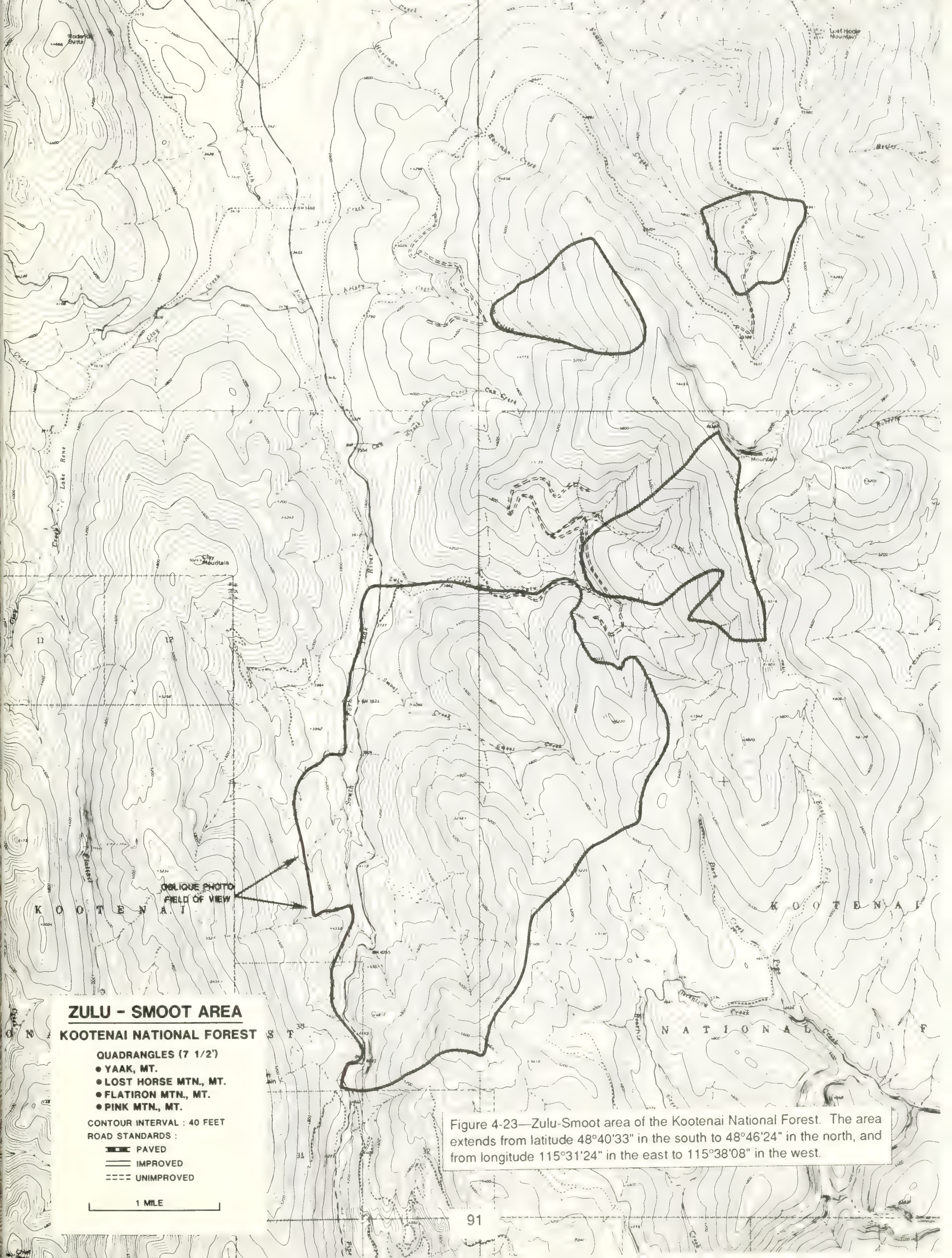

Figure 4-23—Zulu-Smoot area of the Kootenai National Forest. The area extends from latitude 48°40'33" in the south to 48°46'24" in the north, and from longitude 115°31'24" in the east to 115°38'08" in the west.

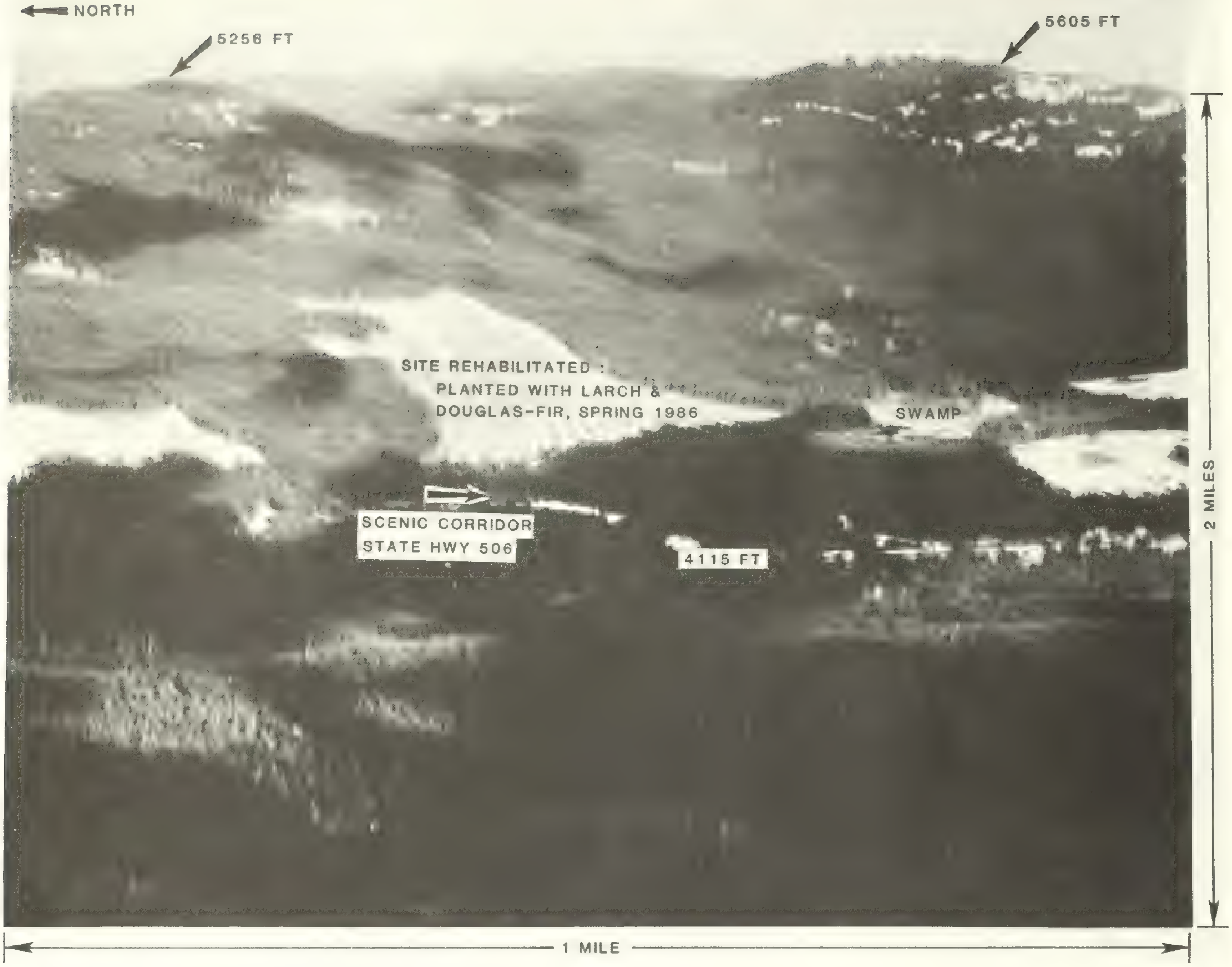

Figure 4-24—Oblique view of the Zulu-Smoot area of the Kootenai National Forest looking west across State Highway No. 506 and three rehabilitated (cleared and planted) acreages toward the head of Smoot Creek; see figure 4-23 for camera viewpoint and field. Width of skyline shown is about 1½ miles; from foreground to skyline in the background is about 2 miles.

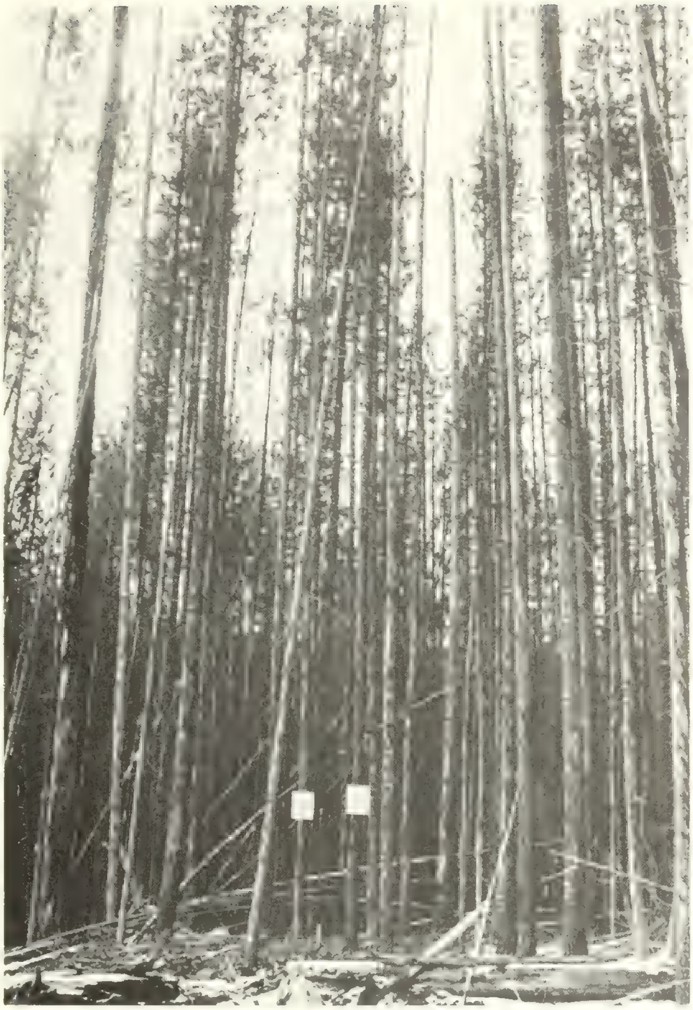

Figure 4-25—Pair of codominant lodgepole pines 3½ to 4 inches in d.b.h. sampled at 4,200 feet near the lower edge of the largest rehabilitated area in the Zulu-Smoot area of the Kootenai National Forest.

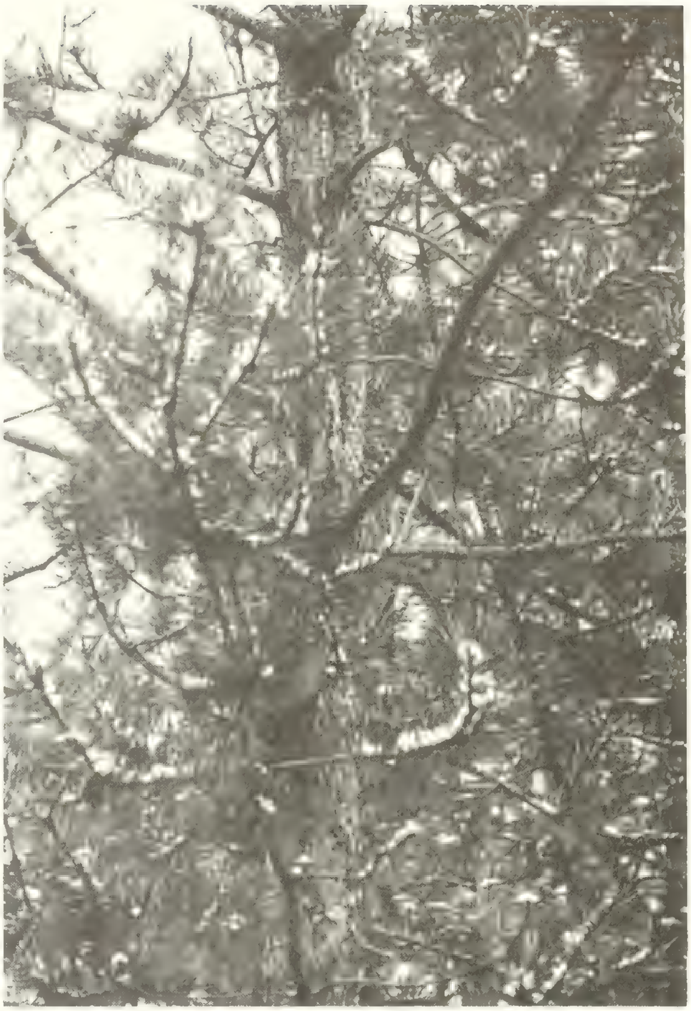

Figure 4-26—A pair of deep stem scars (upper half of photo) probably caused by porcupine damage at early tree age. Such multiple scars were typical on a significant proportion of the trees observed in the Zulu-Smoot area of the Kootenai National Forest.

just east of State Highway No. 506 and below the rehabilitated areas were destructively sampled (fig. 4-25). Some pertinent tree characteristics follow. These tabulated data should not be interpreted as statistically representative of all trees.

See appendix for an explanation of tree selection and procedures for evaluation of mechanical properties in compression parallel to the grain at 10 percent moisture content.

Characteristic	**Tree number 1**	**Tree number 2**
D.b.h. (outside bark), inches	3.60	3.90
Tree height above 6-inch high stump, feet	48.0	51.5
Crown ratio, percent	34.8	43.7
Cone serotiny	closed	closed
Tree age years (number of annual growth rings)		
Stump height	62	70
20 percent of tree height	46	60
Base of live crown	- not measured -	
Diameter inside bark, inches		
Stump height	3.54	3.75
20 percent of tree height	2.95	3.18
Base of live crown	2.00	2.50
Height from stump top to base of crown, inches	376	348
Stem taper inside bark, inches/100 inches		
Below crown	0.41	0.39
Within crown	1.00	0.95
Rings/inch, average for section		
Stump height	35	37
Base of live crown	- not measured -	
Properties of stemwood at 20 percent height		
Moisture content, percent ovendry weight	66.7	73.8
Specific gravity, ovendry weight and green volume	0.473	0.519
Rings/inch in first $1^1/_4$ inches radius	36	32
Ultimate compresssive strength, lb f/in^2	7,190	8,730
Proportional limit, lb f/in^2	5,760	5,590
Modulus of elasticity, lb f/in^2	1,870,000	2,090,000
Compression wood evident?	none	none
Spiral grain angle at surface, degrees	0	0
Bark thickness, single, inch	0.13	0.16
Pith eccentricity, inch	0	0.1

Inventory Data—Inventory data on the area are not complete. Data from several typical stands of lodgepole pine timber type in the area are averaged, however, under the previous pararaph heading, "General Character of the Timber."

Cubic Yield Potential and Height Growth—Although not well documented, potential growth of managed lodgepole stands in the area is estimated at 120 ft^3 per acre per year. Fifty-year height growth in managed stands is estimated to be about 60 feet.

Management Objectives for the Area and Constraints—The site is good for lodgepole pine. Managers of the area would therefore like to see a phased replacement—over the next 20 years—of about 2,100 acres of the present stagnated stands with vigorous, new, controlled-density lodgepole (or mixed-species) stands. The harvests must be timed to enhance wildlife habitat (particularly that of grizzly bears), watershed values, and visual quality (especially along State Highway No. 506).

Other Lodgepole Pine Available in the Area From Public Lands—There are about 16,300 acres of stagnated lodgepole pine on the Yaak Ranger District, and about 94,000 acres of stagnated lodgepole on the entire Kootenai National Forest. The Forest Plan calls for replacement of 34 percent of these stands in the next 50 years, or 640 acres per year.

Forest Products Industry in the Vicinity—There is a major forest products manufacturing complex located at Libby, but it is not presently designed to process subsawlog-size lodgepole pine. Three sizable sawmills manufacturing random-length dimension lumber are located near Eureka, but they are not designed for subsawlog-size lodgepole pine.

Two sizable mills manufacturing 2- by 4-inch studs are located near Bonners Ferry, ID, and another one at Olney, MT. Also, there is a small sawmill located between Yaak and Troy. Manufacturers of roundwood include a post-and-pole operation near Bonners Ferry and a house log producer near Eureka.

The nearest pulp mill is near Missoula, about 190 miles from Libby.

Population in the Vicinity—Lincoln County has a total population of 18,700, based on 1984 statistics. The county seat of Libby is the largest community in the county, with 2,748 people within the town limits and 10,960 within a 4-mile radius (1980). In 1984 the per-capita income was $8,881. In July 1986, 10.1 percent of those in the workforce were unemployed.

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CHAPTER 5: OREGON

INTRODUCTION

In Oregon, lodgepole pine predominates on about 1.9 million acres of the State's commercial forest land, with about 4.0 billion ft^3 of lodgepole pine growing stock and 10.6 billion bd ft of sawtimber (table 5-1). Approximately 5 percent of the softwood growing stock and 3 percent of the softwood sawtimber in the State is lodgepole pine (Farrenkopf 1977; Gedney 1982).

Approximately 46 percent of the lodgepole pine growing stock in Oregon is in trees smaller than the 10-inch d.b.h. class (table 5-2).

The three areas selected for study by managers of public forest lands in Oregon (fig. 5-1) total 24,161 acres in gross area; they are individually described in the following text.

Table 5-1—Volume of lodgepole pine growing stock and sawtimber, and acreage in lodgepole pine, by ownership class, Oregon[1]

Ownership class	Growing stock[2]	Sawtimber volume[3]	Commercial timberland area
	Million ft^3	*Million bd ft International ¼-inch scale*	*Thousand acres*
National Forest (commercial)[4]	3,257	7,792	1,442
Other public	204	776	95
Forest industry	352	1,489	233
Other private	155	560	149
Total	3,968	10,617	[4]1,919

[1] Sources: Farrenkopf (1981), Gedney (1982).

[2] **Growing stock volume** = net volume in cubic feet of live sawtimber and pole timber trees (5 inches d.b.h. and larger) from stump to a minimum 4-inch top outside bark, or to the point where the central stem breaks into limbs.

[3] **Sawtimber volume** = net volume in board feet of the sawlog portion of live sawtimber trees. Sawtimber trees are live trees of commercial species, 9 inches in d.b.h. or larger (softwood), containing at least one 12-foot sawlog or two noncontiguous 8-foot sawlogs, and meeting regional specifications for freedom from defect.

[4] **Commercial timberland** = forest land that is capable of producing crops of industrial wood and not withdrawn from timber utilization by statute or administrative regulation. Areas qualifying as commercial timberland have the capability of producing in excess of 20 ft^3 per acre per year of industrial wood in natural stands.

Table 5-2—Distribution of lodgepole pine growing stock cubic volume by diameter class—Oregon[1]

Diameter class	Volume of growing stock[2]		
	Eastern Oregon[3]	Western Oregon[3]	Total
Inches	*Million ft^3*		
6	1,013	33	1,046
8	740	48	788
10	709	49	758
12	561	47	608
14	316	26	342
16	195	19	214
18	100	9	109
20	51	4	55
22-28	43	5	48
29+	2	0	2
Total	3,730	240	3,970

[1] Sources: Farrenkopf (1981), Gedney (1982).

[2] **Growing stock volume** = net volume in cubic feet of live sawtimber and pole timber trees (5 inches d.b.h. and larger) from stump to a minimum 4-inch top outside bark, or to the point where the central stem breaks into limbs.

[3] Eastern Oregon = area east of crest of Cascade Range; western Oregon = area west of crest of Cascade Range.

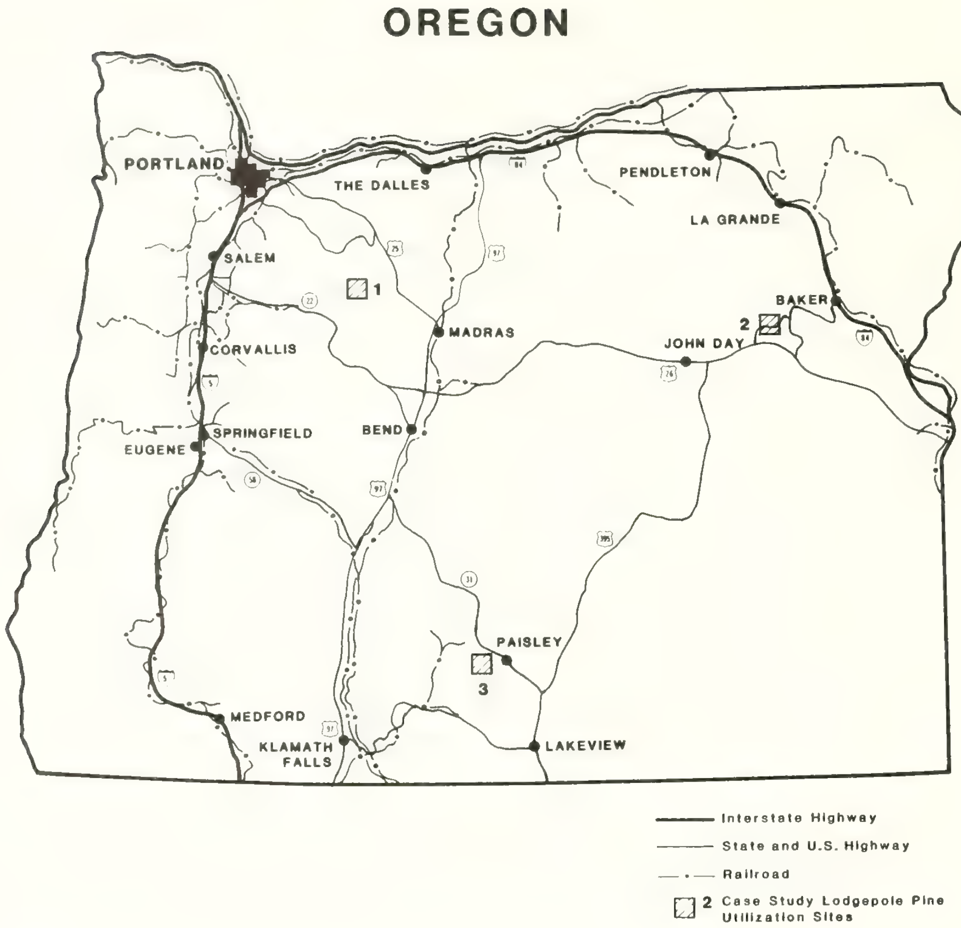


Figure 5-1—Oregon location map. 1. Mount Hood NF (Pinhead Butte) 3,910 acres. 2. Malheur NF (Crawford Meadow) 4,251 acres. 3. Fremont NF (Witham) 7,200 acres.

FREMONT NATIONAL FOREST

Area Name and Location—The Witham area (figs. 5-2, 5-3, and 5-4), which lies at an elevation of 6,500 to 7,700 feet at latitude 42°39' and longitude 120°45', is in the Paisley Ranger District of the Fremont National Forest; the Ranger Station is in Paisley.

The gross area of about 16,000 acres includes about 12,800 acres of lodgepole pine timber type (the balance is about evenly divided between meadows and ponderosa pine type) and falls entirely within Lake County; Lakeview is the county seat. The area is centered around Boulder and Witham Creeks, which are about 5 and 7 air miles south of Summer Lake, respectively. The north-central border of the area is about 4$^1/_2$ air miles due west of Paisley. The center of the area is 39 air miles north-west of Lakeview on a heading of 325°, and is 45 air miles north of the California border.

Maps of the Area—USGS quadrangle 7$^1/_2$' maps needed to depict the area are: Slide Mountain, Harvey Creek, Coffee Pot Creek, and Lee Thomas Crossing.

Administrative Constraints—The area lies within the Lakeview Federal Sustained-Yield Unit. Management regulations for the unit stipulate that the timber cut in the unit must be milled (through the green chain in the case of lumber) in the immediate vicinity of Paisley or Lakeview. Bidders on unit timber may not bid on USDA Forest Service timber outside of the unit for milling in Lakeview or Paisley, but may bid on non-Forest Service timber.

Access—An all-weather gravel road leads 22 miles southwest from Paisley (elevation 4,443 feet) to the center of the southern border of the area (at the junction of Forest Service Roads No. 331 and No. 2823 just north of Ingram Guard Station and close to the camera viewpoint noted on figure 5-3; elevation 6,560 feet). This road junction is 49 road miles from Lakeview (elevation 4,726 feet) via forest roads. Forest Service all-weather road No. 2823 forms the western border of the area. A dirt road traversible by two-wheel-drive vehicles crosses the north-central portion of the area from west to east, and another dirt road penetrates the southern portion.

The nearest railhead is Lakeview on the Goose Lake 55 railroad. This Lake County-owned railroad connects with the Southern Pacific railroad at Alturas, CA, about 55 miles to the south. Lakeview is 45 miles south of Paisley via State Highway No. 31 and U.S. Highway No. 395. For highway distances from Lakeview to various market centers in the United States, see table 1-2.

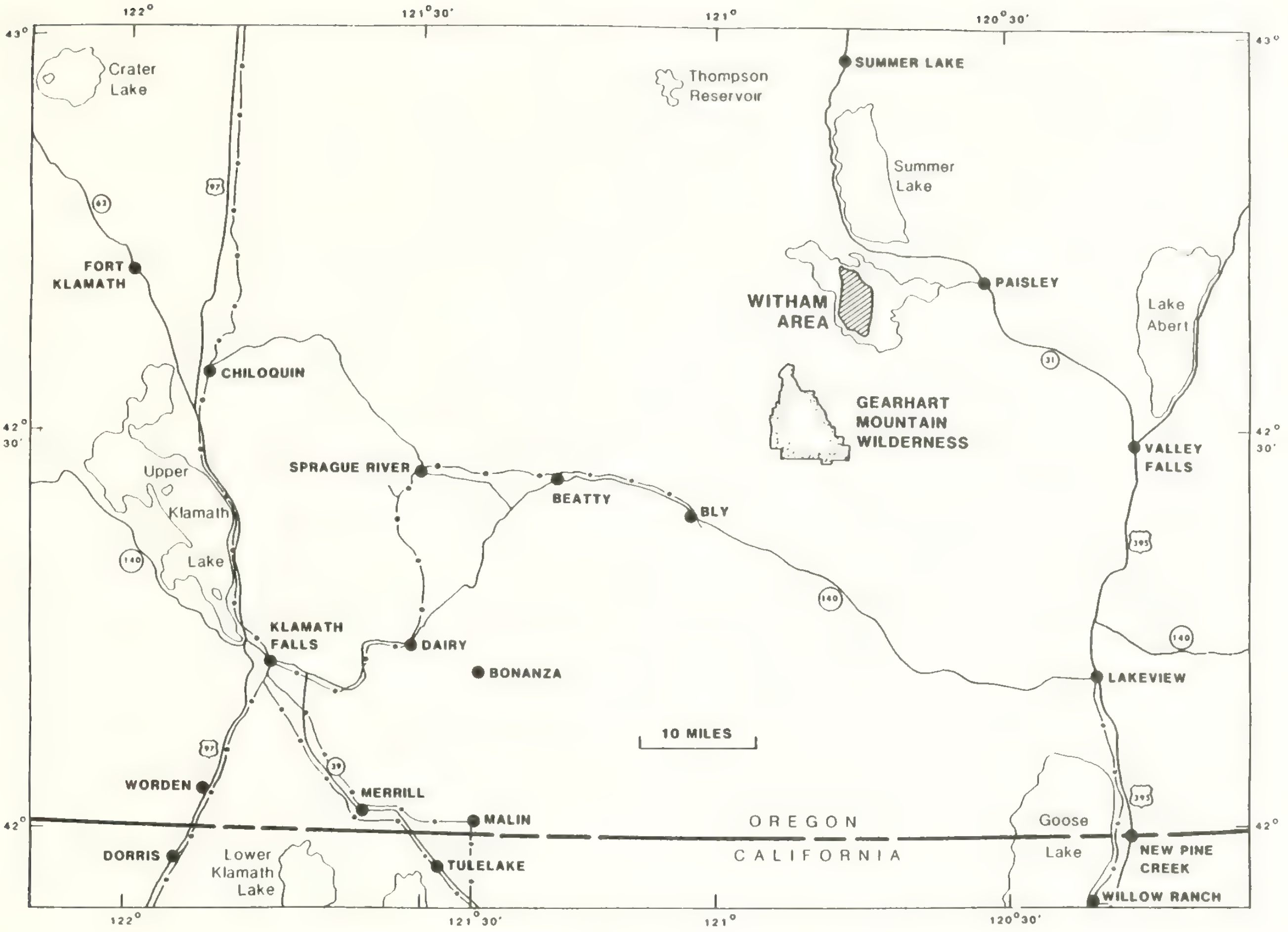


Figure 5-2—Vicinity map for the Witham area of the Fremont National Forest in Oregon.

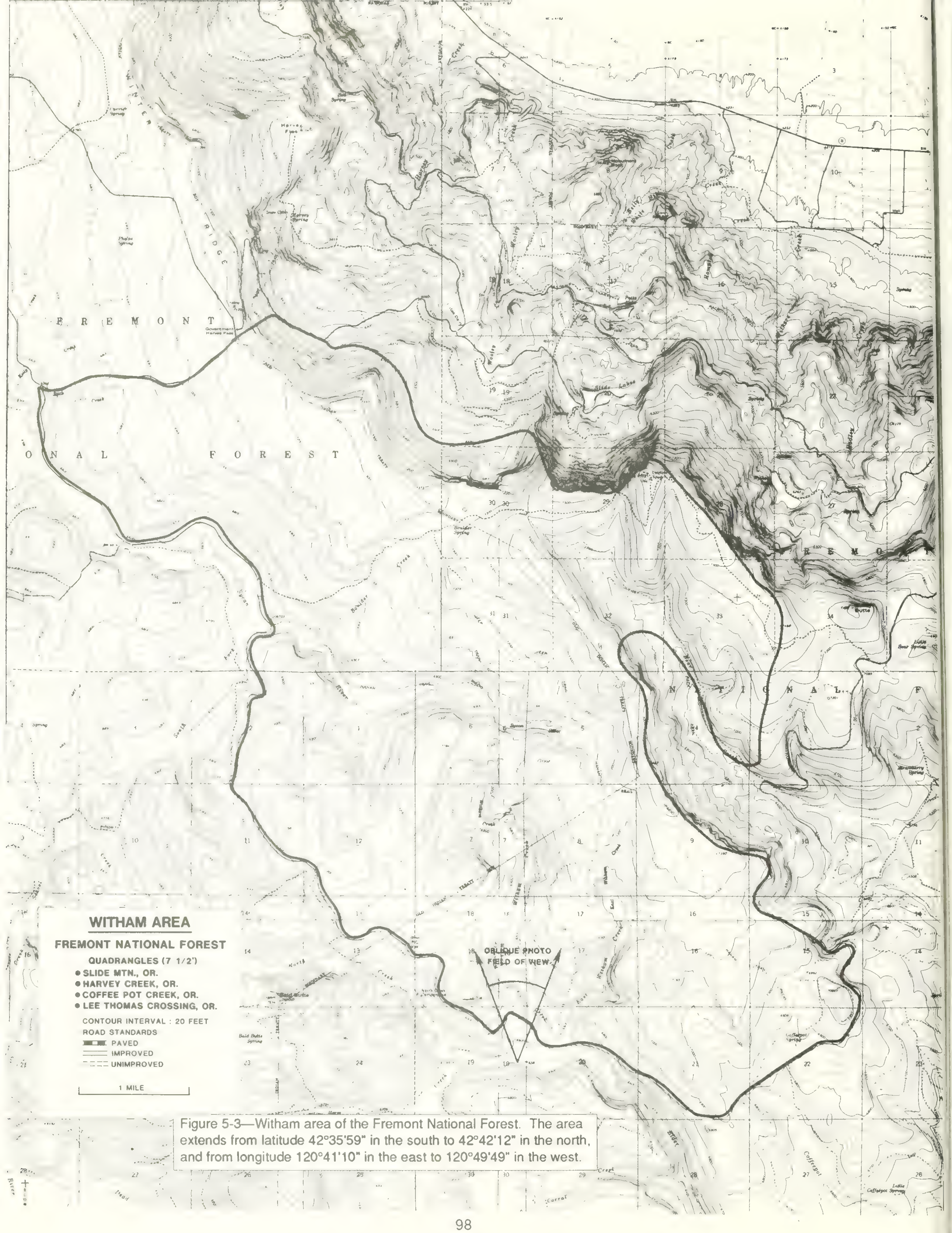


Figure 5-3—Witham area of the Fremont National Forest. The area extends from latitude 42°35'59" in the south to 42°42'12" in the north, and from longitude 120°41'10" in the east to 120°49'49" in the west.

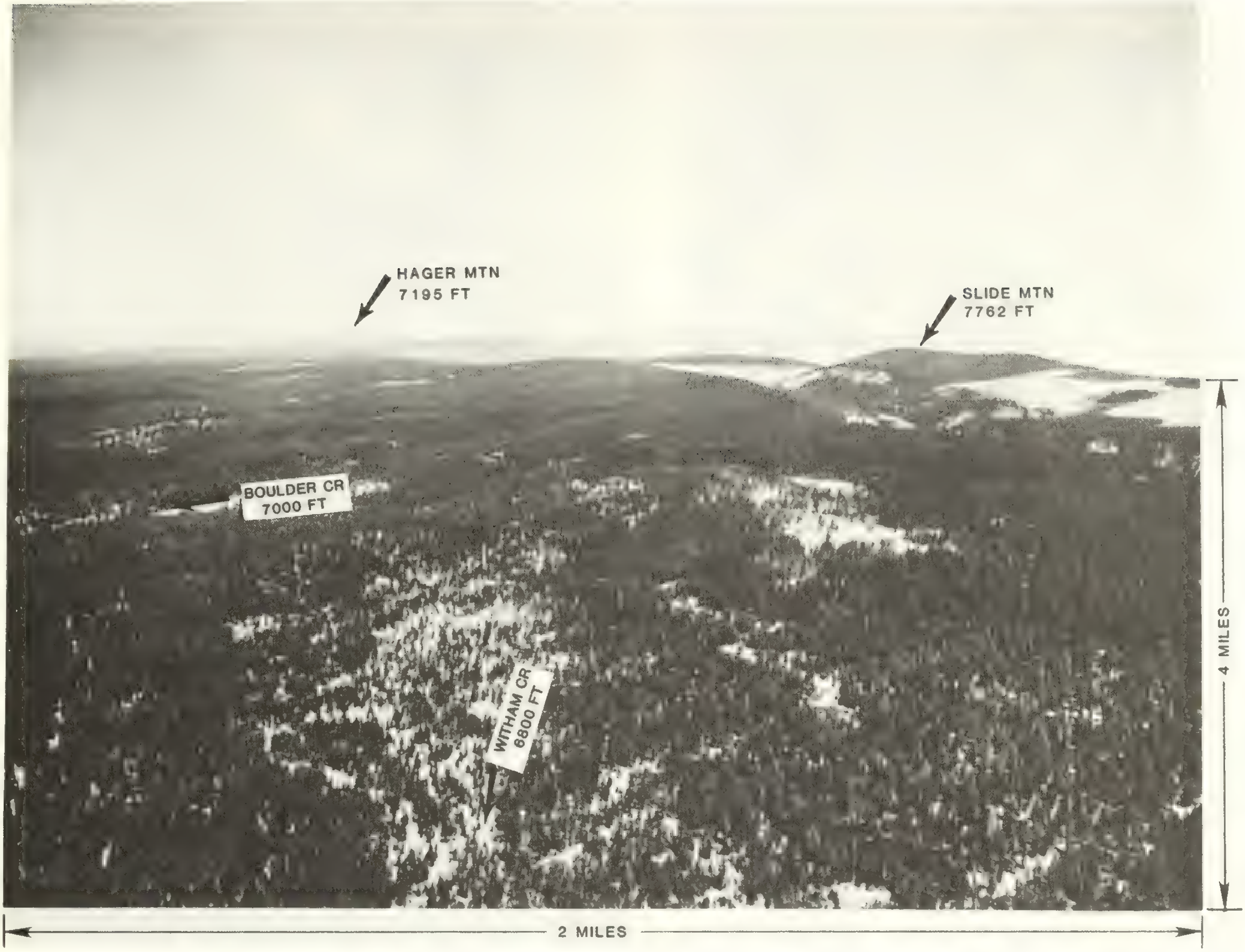


Figure 5-4—Oblique view of the Witham area of the Fremont National Forest looking north up Witham Creek toward Slide Mountain and Summer Lake at upper right. Width of foreground is about 2 miles; from foreground to the top of Slide Mountain is about 4 miles. See figure 5-3 for camera viewpoint and field.

Terrain and Soil—As previously noted, the area lies between 6,500 and 7,700 feet elevation, with nine-tenths of the area having slopes less than 45 percent. Soils are of pumice, a lightweight volcanic ash, several feet deep. There is virtually no undergrowth, and very little dead timber on the ground (figs. 5-5 and 5-6). Except for erodible soils, there are no special obstacles to harvesting.

Annual Precipitation and Duration of Snow-free Season—Annual precipitation totals about 25 inches. Winter snow accumulation is commonly 3 to 4 feet. The snow-free season generally extends from June 1 to mid-October.

General Character of the Timber—The overstory trees—survivors from past mountain pine beetle attacks—are 150 to 200 years old and not very tall (fig. 5-5). For example, a dominant lodgepole 11 inches in d.b.h. felled 3 miles north of the road intersection mentioned earlier measured only 53 feet in height and was 195 years old. Typically there is a sparse understory among the older relicts. Crown ratios are generally greater than 50 percent. In the vicinity of the area shown in figure 5-5, there averaged about 450 live lodgepole pines per acre larger than 3 inches in d.b.h.; the 450 averaged about 7 inches in d.b.h. Typically there is little ground vegetation and virtually no duff. Meadows and stream bottoms evidently afford considerable forage, however, because mule deer are numerous in the area.

Lower stem sections of a significant proportion of trees near the previously mentioned road junction on the southern border of the area are deeply scarred (fig. 5-6).

There is no significant dwarf mistletoe infestation in the area, and little current mortality from mountain pine beetle. Managers predict, however, that the mountain pine beetle will kill most of the larger trees within 15 years.

Within the area there have been no significant harvests in the past, and none are planned in the immediate future because of lack of markets for the stumpage, and because of an average maintenance levy of about $10 per M bd ft Scribner scale for sawlogs hauled over Forest Service roads leading to area mills.

Data on Sample Trees—A pair of lodgepole pines measuring 3½ to 4 inches in d.b.h. were destructively sampled from the tall understory of a stand adjacent to,

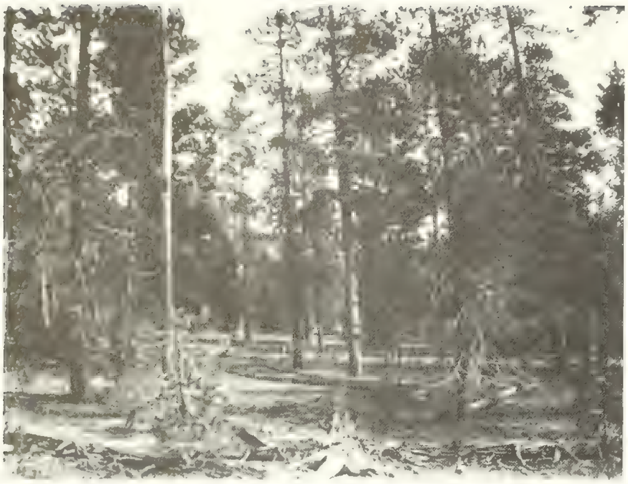


Figure 5-5—Typical stand of lodgepole pines at 7,250 feet along the southwestern edge of the Witham area of the Fremont National Forest (immediately adjacent to where a pair of trees were destructively sampled). Excluding those less than 3 inches in d.b.h., these trees averaged about 7 inches in d.b.h.

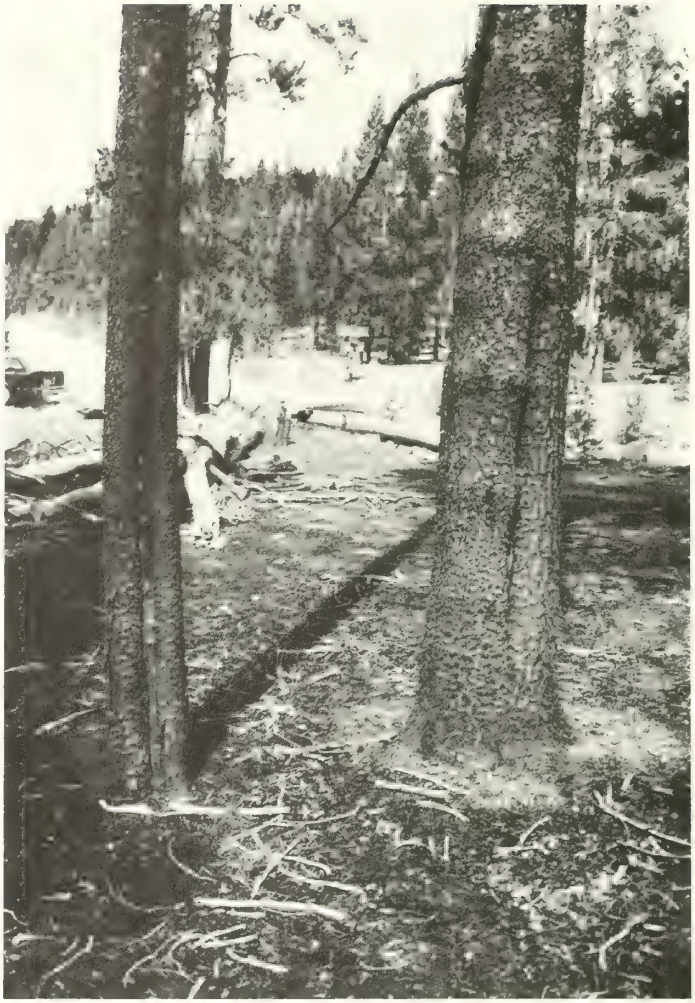


Figure 5-6—Deep butt scars of unidentified origin were evident in a significant number of lodgepole pines growing in the southwest quadrant of the Witham area of the Fremont National Forest.

and similar to, the stand depicted in figure 5-5. Some pertinent tree characteristics follow. These data should not be interpreted as statistically representative of all trees.

See appendix for an explanation of tree selection and procedures for evaluation of mechanical properties in compression parallel to the grain at 10 percent moisture content.

Characteristic	Tree number 1	Tree number 2
D.b.h. (outside bark), inches	3.73	3.62
Tree height above 6-inch high stump, feet	24.7	25.3
Crown ratio, percent	68.6	72.9
Cone serotiny	open	open
Tree age years (number of annual growth rings)		
Stump height	121	114
20 percent of tree height	62	51
Base of live crown	46	42
Diameter inside bark, inches		
Stump height	3.87	3.88
20 percent of tree height	3.46	3.36
Base of live crown	3.29	3.16
Height from stump top to base of live crown, inches	93	82
Stem taper inside bark, inches/100 inches		
Below crown	0.62	0.88
Within crown	1.62	1.43
Rings/inch, average for section		
Stump height	63	59
Base of live crown	28	27
Properties of stemwood at 20 percent height		
Moisture content, percent ovendry weight	92.0	136.2
Specific gravity, ovendry weight and green volume	0.471	0.390
Rings/inch in first $1\frac{1}{4}$ inches radius	33	34
Maximum crushing strength, lb f/in^2	5,410	4,390
Proportional limit, lb f/in^2	2,830	2,290
Modulus of elasticity, lb f/in^2	840,000	740,000
Compression wood evident?	slight	significant
Spiral grain angle at surface, degrees	2	1
Bark thickness (single), inch	0.13	0.11
Pith eccentricity, inch	0.1	0.1

Inventory Data—Inventory data on the area are incomplete. As previously mentioned, most of the stands are comprised of old trees that are relicts of previous attacks by mountain pine beetle, with a sparse understory of smaller trees. Data from examination #877 made in 1981 on 4,388-acre compartment 3207 in the area yielded the following diameter distribution:

Diameter class *Inches*	Live trees per acre
1.0-1.9	125
2.0-2.9	71
3.0-3.9	107
4.0-4.9	18
5.0-6.9	80
7.0-8.9	33
9.0-10.9	58
11.0-12.9	27
13.0-14.9	11
15.0-16.9	6
17.0-18.9	2
Total	538

The lodgepole pines in this stand, which had 235 live trees in the 4-inch and larger classes, are somewhat larger than the average for the entire area. Since 1981 bark beetles have killed many of the larger trees in this compartment.

Cubic Yield Potential and Height Growth—Although data are not well documented, managers of the area estimate that managed lodgepole stands in the area should grow 20 to 30 ft^3 of stemwood per acre per year. Fifty-year height growth in managed stands is estimated to be about 35 feet.

Management Objectives for the Area and Constraints—Because of lack of stumpage markets, in part due to road maintenance costs levied on loggers, attainment of management objectives is hard to accomplish. The primary objective is phased harvest of the overaged decadent stands and replacement with vigorous, new, controlled-density lodgepole stands. Such harvests must be timed to enhance wildlife habitat (particularly that of deer) and preserve watershed values.

Sawtimber stumpage within the area, in the few sales accomplished, is usually sold for about $5 per M bd ft Scribner scale plus about $10 per M bd ft for road maintenance. Commercial firewood cutters pay a minimum of $5 per cord stumpage plus $1 per cord for road maintenance.

Other Lodgepole Pine Available in the Area From Public Lands—Within the unit there are another 6,000 acres (additional to that within the Witham area) of similar lodgepole pine timber mixed among stands of other species.

Outside of the unit, but within the Fremont National Forest, there are still another 111,000 acres of lodgepole pine timber type.

Forest Products Industry in the Vicinity—The unit supplies logs—mostly large ponderosa pine and white fir—to five sawmills, each cutting 12 to 16 million bd ft of random-length lumber. One of the mills is in Paisley, and the remaining four are in Lakeview. One of the Lakeview mills is building a facility to mill small white fir logs.

Not drawing logs from the unit are the substantial and various wood conversion operations in Klamath Falls, about 95 highway miles west of Lakeview.

Population in the Vicinity—Lake County has a total population of 7,600, based on 1984 data. Lakeview has a population of about 2,800 and Paisley about 360.

In 1985, annual per-capita income in the county was $14,600; 12.5 percent of the workforce in the county was unemployed in January 1986.

MALHEUR NATIONAL FOREST

Area Name and Location—The Crawford Meadow area (figs. 5-7, 5-8, and 5-9), which lies at an elevation of 4,600 to 5,800 feet at latitude 44°37' and longitude 118°22', is in the Long Creek Ranger District of the Malheur National Forest; the Ranger Station is in John Day.

The gross area of 4,251 acres includes about 2,100 acres of lodgepole pine timber type and falls within Baker and Grant Counties. Baker and Canyon City are the respective county seats. The area, which is about midway on a line between Baker and John Day, surrounds Crawford Meadow and extends east of it. From Austin Junction, the center of the area is about 8 miles northeast on a heading of 55°.

Maps of the Area—USGS quadrangle 7½' maps needed to depict the area are: Greenhorn, Whitney, Austin, and Pogue Point.

Access—U.S. Highway No. 26 from John Day east to Austin Junction and Unity runs south of the area. From Austin Junction (28 miles east of John Day on U.S. Highway No. 26), a secondary paved highway (State No. 7) runs northeast 8 miles to Tipton Site—and hence on to Whitney and Baker. Baker is about 33 miles from Tipton Site. Forest Service Road No. 2620 leads south from Tipton Site for about 1 mile to a road junction within the area just northeast of Crawford Meadow at an elevation of 5,137 feet. From this junction an unimproved road leads southeast to the eastern border of the area, and an all-weather road leads southwest past Crawford Meadow and on down Crawford Creek to U.S. Highway No. 26 at Phipps Meadows (figs. 5-8 and 5-9).

The nearest railhead is in Baker on the Union Pacific line between Pendleton and Payette, ID. For highway distances from Baker to various market centers in the United States, see table 1-2.

Terrain and Soil—As previously noted, the area lies between 4,600 and 5,800 feet elevation, with nearly all the acreage having slopes of less than 30 percent. Soils are 30 to 60 inches in depth, with the top 6 to 24 inches derived principally from volcanic ash. Unimproved roads in the area, when dry, are deeply layered in dust. Large stones and rock outcroppings are not evident, and undergrowth is minimal.

Annual Precipitation and Duration of Snow-free Season—Annual precipitation totals about 25 inches. In winter, snow commonly accumulates to a depth of 4 feet. The snow-free season generally extends from the first of June through October.

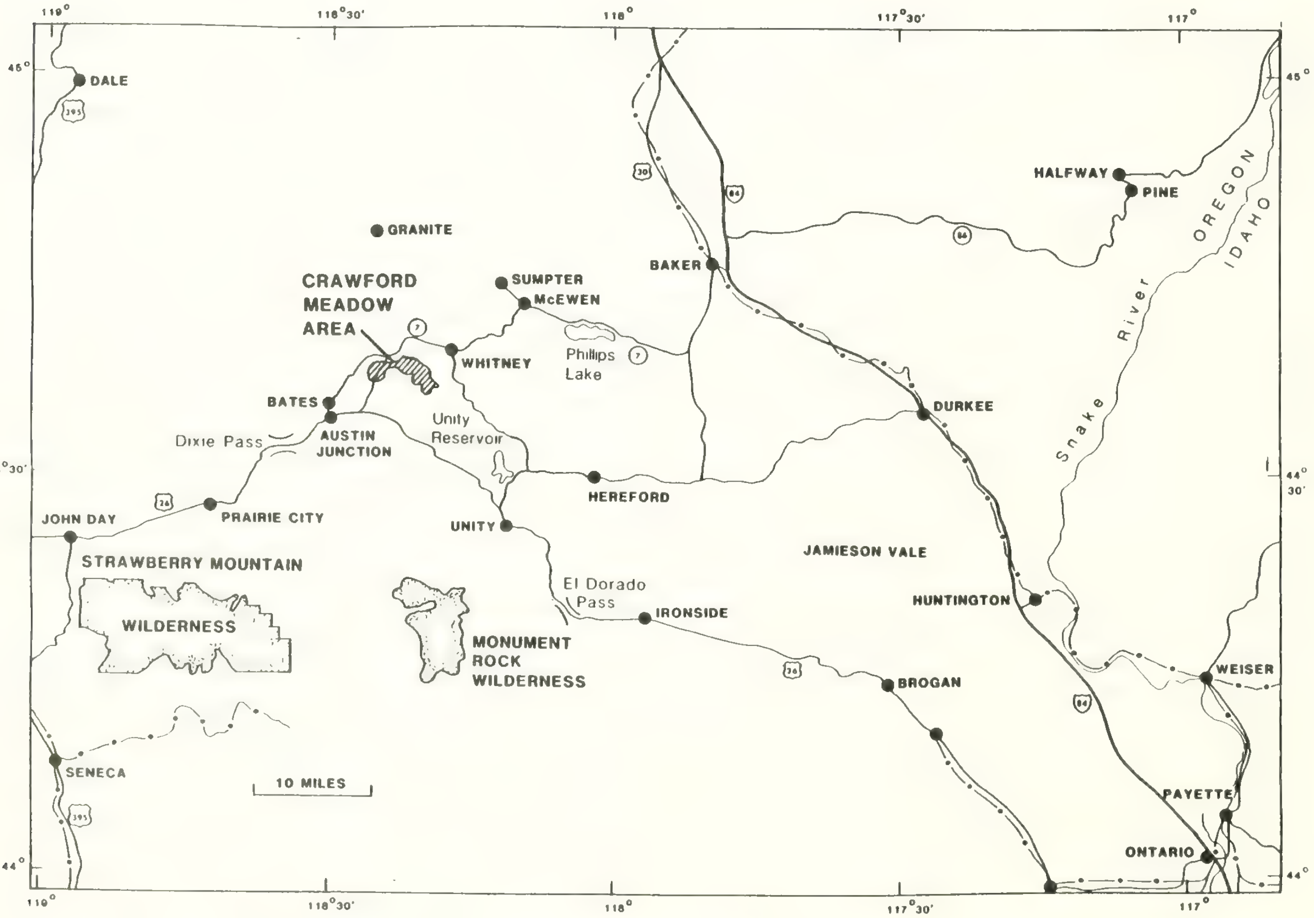


Figure 5-7—Vicinity map for the Crawford Meadow area of the Malheur National Forest.

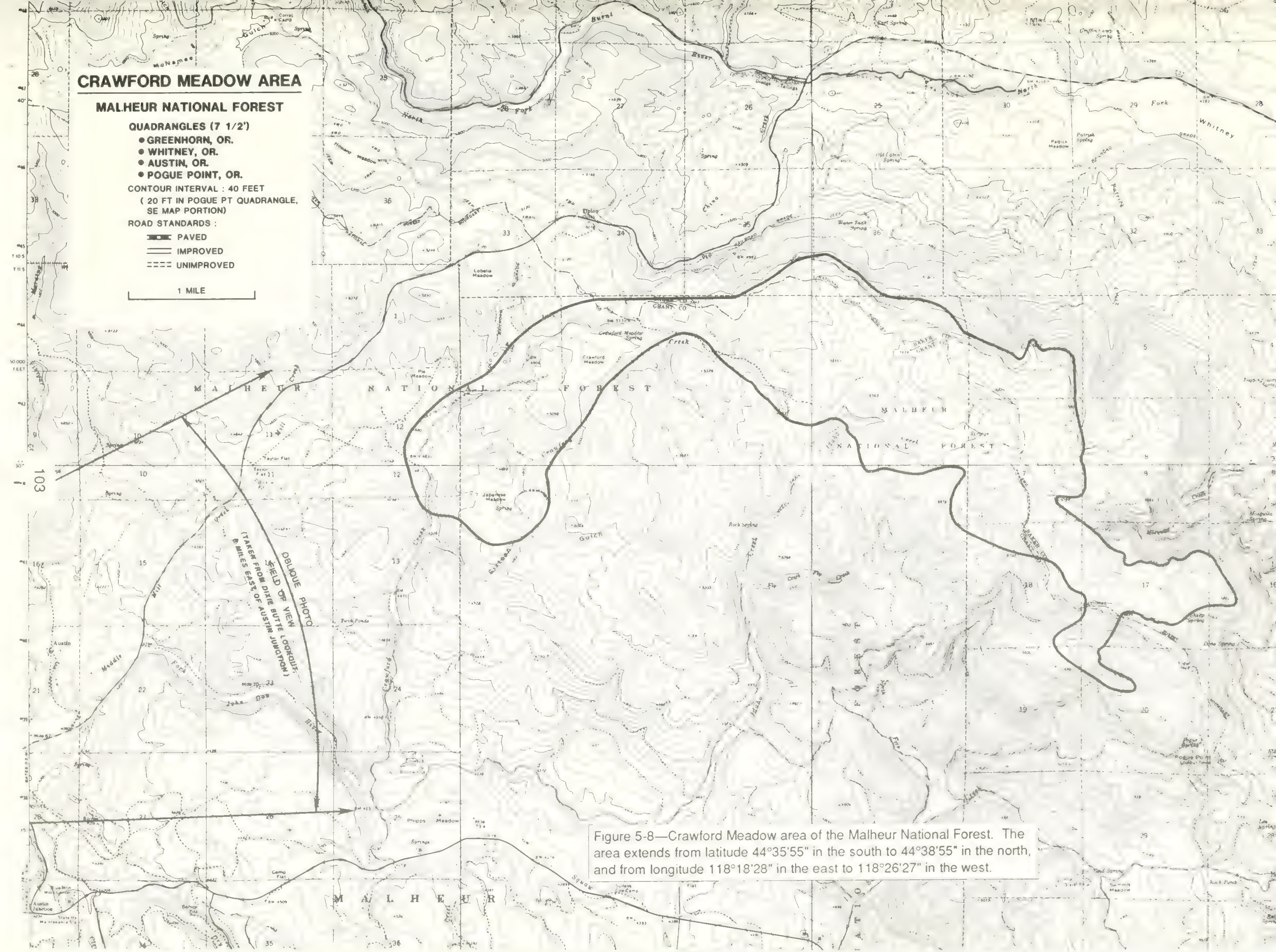


Figure 5-8—Crawford Meadow area of the Malheur National Forest. The area extends from latitude 44°35'55" in the south to 44°38'55" in the north, and from longitude 118°18'28" in the east to 118°26'27" in the west.

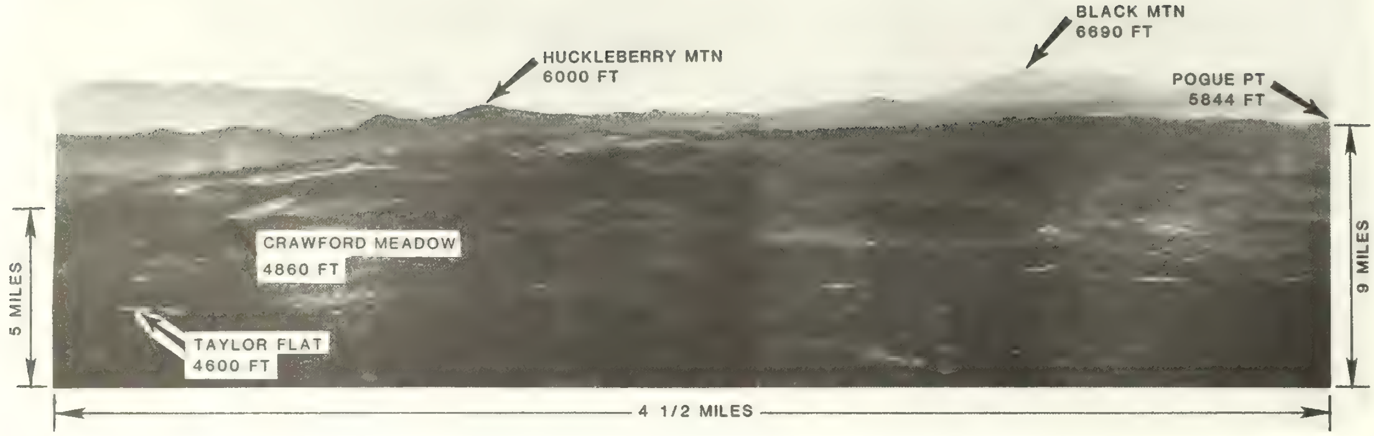


Figure 5-9—Oblique view of the Crawford Meadow area of the Malheur National Forest looking east-northeast from Dixie Butte Lookout. See figure 5-8 for camera field of view. Width of foreground shown is about 4½ miles; from foreground to Pogue Point in the right background is about 9 miles.

General Character of the Timber—Of the 2,100 acres of lodgepole pine timber type in the area, about 1,000 acres carry stagnated dense stands of trees 50 to 60 years old, mostly 2 to 4 inches in d.b.h., and with few trees larger than 6 inches in d.b.h. (fig. 5-10). These stagnated dense stands are mainly to the east of Crawford Meadow on relatively flat ground; many have 3,000 live stems per acre.

Because of significant mortality from past attacks by mountain pine beetles, other stands east of Crawford Meadow have 1,100 to 1,500 live stems per acre along with 600 to 700 standing dead stems and much down timber (fig. 5-11). Natural regeneration occurs easily, and growth on clearcut areas is vigorous (fig. 5-12). On this eastern portion of the area, lodgepole pines that have been thinned to about 150 trees per acre average about 9 inches in d.b.h. at age 52 years.

The lodgepole pines growing on the west end of the area are of somewhat larger diameter than those in the stagnated eastern stands (although not of sawlog size) and are in unthinned mixtures with larch, Douglas-fir, and true firs.

Most of the larger trees in the area have been killed by mountain pine beetles, much dwarf mistletoe is evident on surviving trees, and significant numbers of trees are under attack by western gall rust.

No significant harvests have been made in the area, and none are planned for the immediate future—except for local use as posts and poles.

Data on Sample Trees—A pair of codominant lodgepole pines 3½ to 4 inches in d.b.h. were destructively sampled from level terrain at 5,600 feet elevation about 2½ miles east of Crawford Meadow (fig. 5-11). Some pertinent tree characteristics follow. These tabulated data should not be interpreted as statistically representative of all trees.

See appendix for an explanation of tree selection and procedures for evaluation of mechanical properties in compression parallel to the grain at 10 percent moisture content.

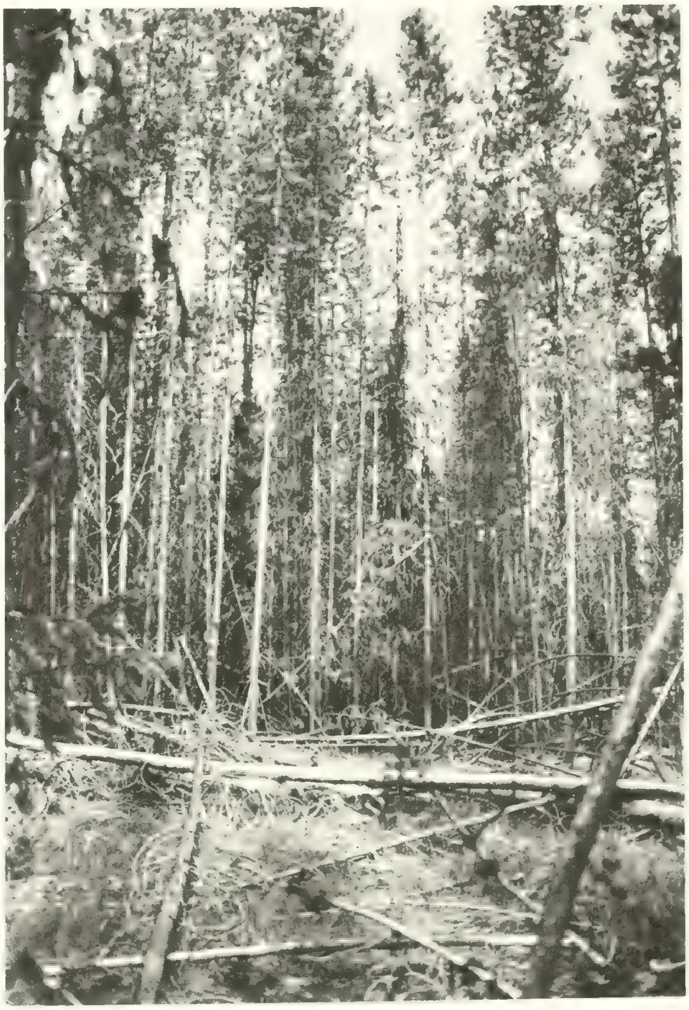


Figure 5-10—Sapling/pole stand at 5,600 feet elevation about 2½ miles east of Crawford Meadow in the Malheur National Forest.

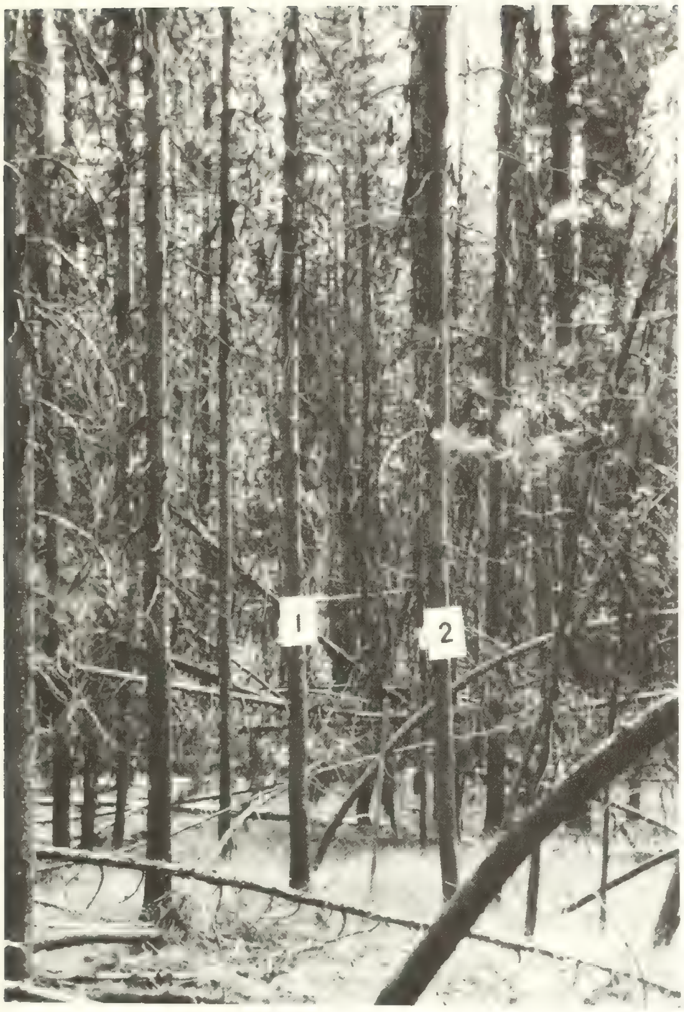


Figure 5-11—Pair of codominant lodgepole pines 3½ to 4 inches in d.b.h. sampled at 5,600 feet elevation about 2½ miles east of Crawford Meadow in the Malheur National Forest.

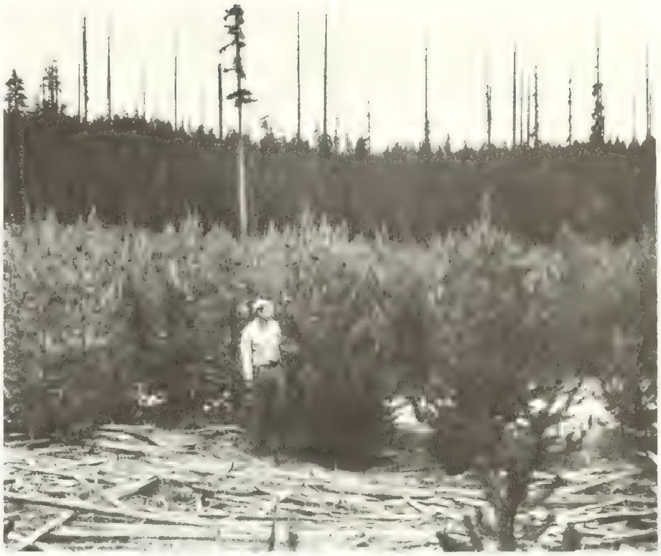


Figure 5-12—Natural unthinned lodgepole pine regeneration 10 years after completion of a small clearcut (a noncommercial stand replacement operation in which severed stems were bulldozed into piles) in the Crawford Meadow area of the Malheur National Forest.

Characteristic	Tree number 1	Tree number 2
D.b.h. (outside bark), inches	3.95	3.63
Tree height above 6-inch high stump, feet	37.5	37.8
Crown ratio, percent	59.3	55.6
Cone serotiny	open	open
Tree age years (number of annual growth rings)		
Stump height	55	53
20 percent of tree height	42	21
Base of live crown	34	28
Diameter inside bark, inches		
Stump height	4.07	3.71
20 percent of tree height	3.44	3.32
Base of live crown	3.01	3.10
Height from stump top to base of crown, inches	183	201
Stem taper inside bark, inches/100 inches		
Below crown	0.58	0.30
Within crown	1.13	1.23
Rings/inch, average for section		
Stump height	27	29
Base of live crown	22	18
Properties of stemwood at 20 percent height		
Moisture content, percent ovendry weight	101.7	88.5
Specific gravity, ovendry weight and green volume	0.439	0.431
Rings/inch in first 1¼ inches radius	19	26
Ultimate compresssive strength, lb f/in^2	6,650	5,070
Proportional limit, lb f/in^2	3,590	3,570
Modulus of elasticity, lb f/in^2	1,460,000	1,020,000
Compression wood evident?	none	none
Spiral grain angle at surface, degrees	1	3
Bark thickness (single), inch	0.12	0.10
Pith eccentricity, inch	0.4	0.1

Inventory Data—Inventory data on the area are lacking. For general comments about diameter classes and stocking, see text under paragraph heading "General Character of the Timber."

Cubic Yield Potential and Height Growth—Although data are not well documented, managers of the area estimate that in managed stands, growth should be about 15 rings per inch at 80 to 100 ft^2 basal area, yielding about 45 ft^3 of stemwood per acre per year. Fifty-year height growth in managed stands is estimated to be about 40 feet.

Management Objectives for the Area and Constraints—Managers do not plan to thin the present stands. The primary objective is phased harvest of the stagnated stands and replacement with vigorous, new, controlled-density lodgepole stands. Such harvests would be timed to enhance winter range for elk and to preserve watershed values.

Lack of markets for subsawlog-size trees is the major constraint to accomplishment of the objectives. Dead trees harvested for firewood sell for about $2.50 per cord stumpage, and lodgepole pine sawtimber stumpage may bring only $5.00 per M bd ft Scribner scale.

Other Lodgepole Pine Available in the Area From Public Lands—Lodgepole pine timber type comprises only about 5 percent of the acreage on the entire 1,460,000-acre Malheur National Forest, so available lodgepole is limited. The Big Cow Burn area of the Prairie City Ranger District (about 14 miles southeast of Prairie City), however, does contain about 20,000 acres of lodgepole pine timber for which there is little market because trees are small in diameter, short, and have more-than-average taper.

Forest Products Industry in the Vicinity—Except for small-log dimension and stud mills in Prairie City and Long Creek (both associated with a cogeneration plant producing electric power for sale), sawmills in the area mainly cut ponderosa pine. There are two such mills in John Day, one in Pilot Rock, and several in the vicinity of Baker. There are no pulp mills in the vicinity, but there is a fiberboard plant in Pilot Rock.

There are numerous portable mills in the area, including one that mills house logs from lodgepole pine. Also, there is a small post-and-pole operation in Bates.

Population in the Vicinity—In 1984, Grant County had a total population of 8,230. At that time John Day, the largest town in the county, had 2,012 within the city limits and about 4,938 within a 15-mile radius. In 1983, per-capita income in Grant County was $10,737, and 14.4 percent of those in the workforce were unemployed.

Baker County has a total population (1986) of 16,200. The town of Baker, largest in the county and the county seat, has a population of 9,470. In 1980, per-capita income in Baker County was $8,315, and 13 percent of those in the workforce were unemployed.

MOUNT HOOD NATIONAL FOREST

Area Name and Location—The Pinhead Butte area (figs. 5-13, 5-14, and 5-15), which lies at an elevation of 2,700 to 5,500 feet at latitude 44°53' and longitude 121°49', is in the Clackamas Ranger District of the Mount Hood National Forest in Oregon; the Ranger Station is in Ripple Brook.

The gross area of 3,910 acres is entirely forested with lodgepole pine timber type. The northern half of the area is in Clackamas County, and the southern half in Marion County. The county seats are Oregon City and Salem, respectively. The area is centered around the headwaters of the Clackamas River immediately west of, and adjoining, the Warm Springs Indian Reservation. From Mount Hood the center of the area is about 32 air miles south-southwest, and the Mount Jefferson Wilderness area is 2 or 3 miles south of the area's southern border. From Estacada the area is 36 air miles southeast on a heading of 135°.

Map of the Area—The area falls entirely within a single USGS 15' quadrangle map: Breitenbush Hot Springs, OR.

Access—All-weather roads lead from the area to Estacada (47 miles), and to the railhead towns of Mill City (about 50 miles), Molalla (96 miles), and Hood River (96 miles). Although figure 5-14 shows only a few access roads, there is today an extensive network of improved USDA Forest Service roads throughout most of the area.

For highway distances from Portland (that is, from near Molalla and Estacada) to various market centers in the United States, see table 1-2.

Terrain and Soil—As previously noted, the area lies between 2,700 and 5,500 feet elevation, with nearly seven-eighths of the area having slopes less than 45 percent. Litter is 2 to 3 inches thick over a gravelly cobbly loam 6 to 9 inches thick; subsoils are gravelly silt or sandy loams 3 to 4 feet deep. Few large stones or rocky outcroppings are visible.

Annual Precipitation and Duration of Snow-free Season—Annual precipitation totals 30 to 35 inches, with snow accumulations of 3 to 10 feet common at upper elevations in winter. In spite of the sometimes heavy snow accumulations, logging operations in the vicinity are continued throughout most winters.

General Character of the Timber—Most of the lodgepole pines in the area are both large in diameter and tall for the species (fig. 5-16). A codominant measured east of Sisi Butte was 10.1 inches in diameter and 74 feet in height; most overstory trees in the vicinity were 8 to 12 inches in d.b.h., with numerous 16-inch trees. In comparison to other areas studied, diameter growth is rapid.

While many stands would provide excellent straight house logs of larger than usual diameter, a significant proportion of trees observed had short crooks in lower stem sections (fig. 5-17).

Some infestation by dwarf mistletoe is evident, but there is no mortality from mountain pine beetle. Most trees are 60 to 90 years old (some 150 years old), so it appears that there have been no major forest fires since near the turn of the century.

There has been no harvest activity in recent years, and—lacking markets—none is planned in the near future.

Data on Sample Trees—Two adjacent lodgepole pines 3½ to 4 inches in d.b.h. from the understory of a stand at 4,400 feet elevation just east of Sisi Butte were destructively sampled (fig. 5-18). Some pertinent tree characteristics follow. These tabulated data should not be interpreted as statistically representative of all trees of this diameter.

See appendix for an explanation of tree selection and procedures for evaluation of mechanical properties in compression parallel to the grain at 10 percent moisture content.

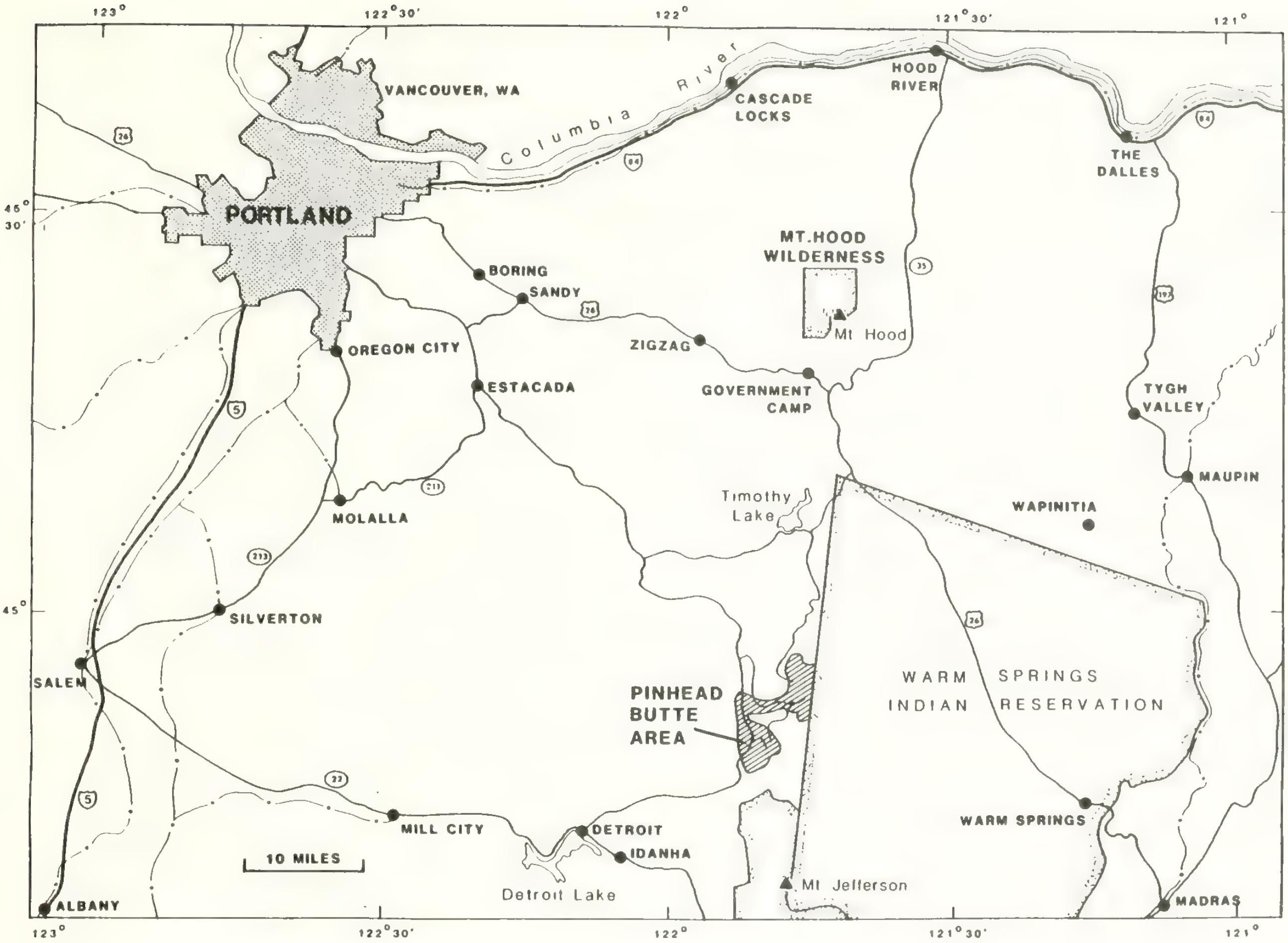
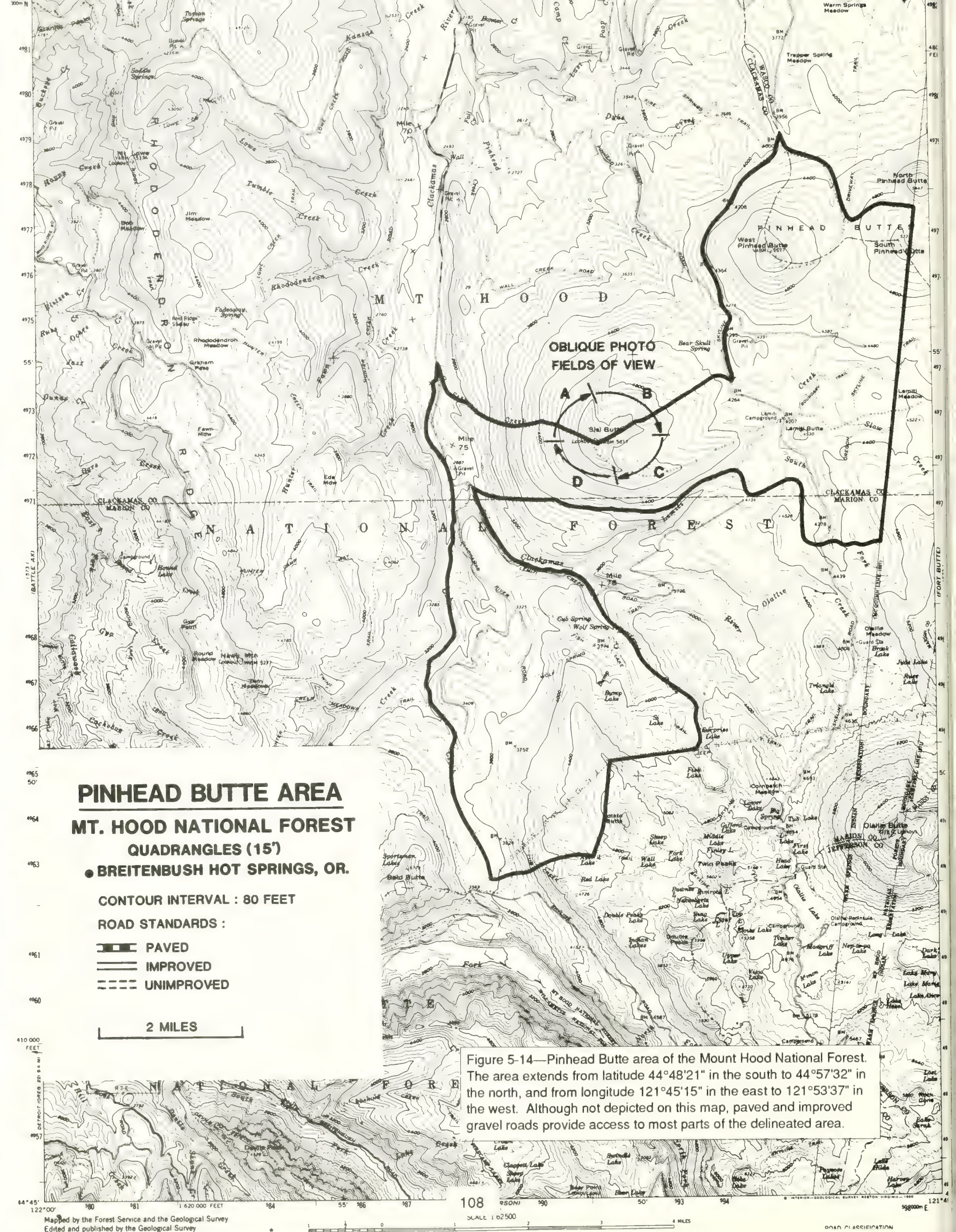


Figure 5-13—Vicinity map for the Pinhead Butte area of the Mount Hood National Forest in Oregon.



PINHEAD BUTTE AREA

MT. HOOD NATIONAL FOREST

QUADRANGLES (15')

● BREITENBUSH HOT SPRINGS, OR.

CONTOUR INTERVAL : 80 FEET

ROAD STANDARDS :

- PAVED
- IMPROVED
- UNIMPROVED

2 MILES

Figure 5-14—Pinhead Butte area of the Mount Hood National Forest. The area extends from latitude 44°48'21" in the south to 44°57'32" in the north, and from longitude 121°45'15" in the east to 121°53'37" in the west. Although not depicted on this map, paved and improved gravel roads provide access to most parts of the delineated area.

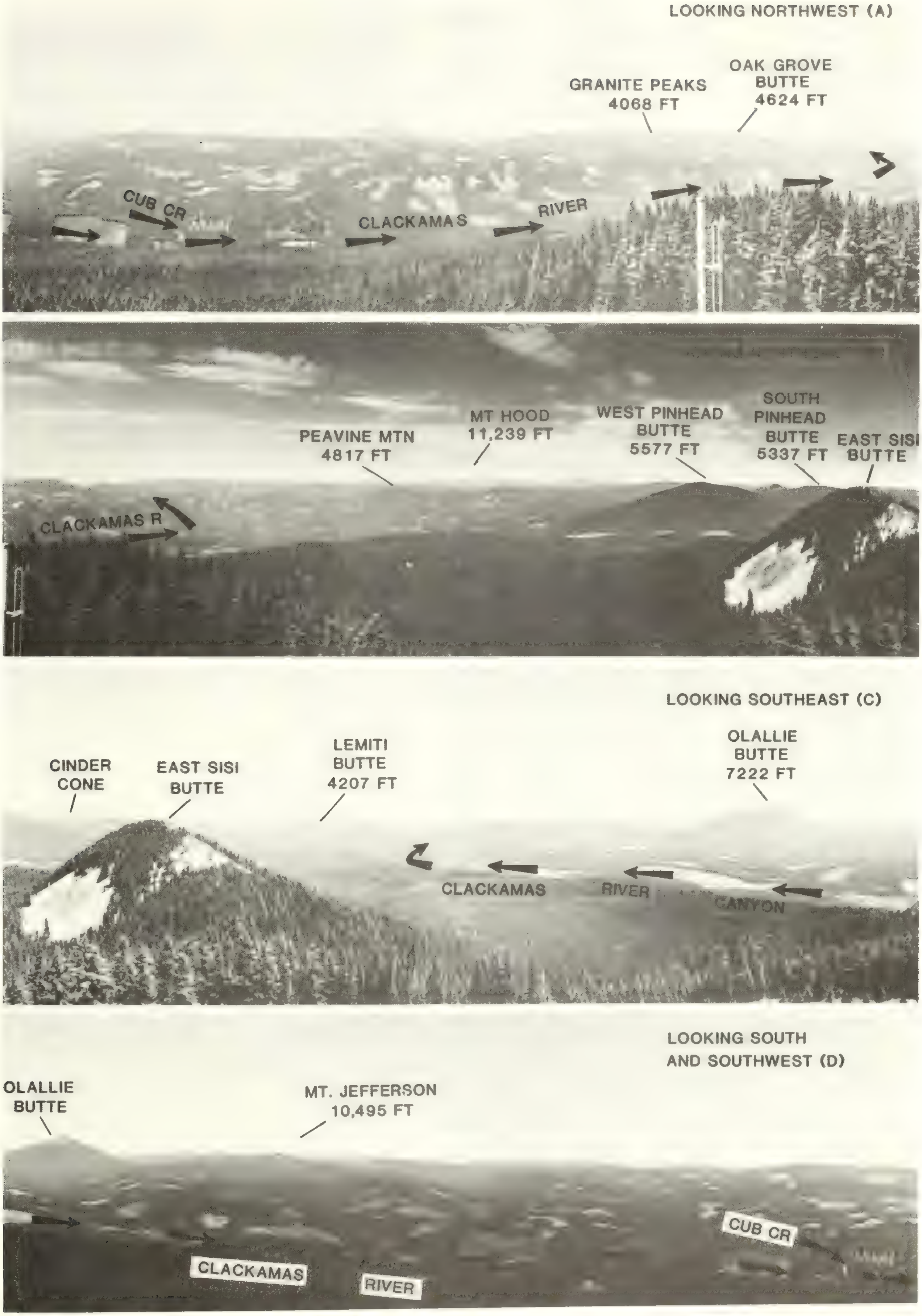


Figure 5-15—The Pinhead Butte area of the Mount Hood National Forest as seen from Sisi Butte through a camera rotated to provide a 360-degree scan in the four views shown. See figure 5-14 for camera viewpoint and fields of each view. The lodgepole pine acreage is in the foreground of each view.

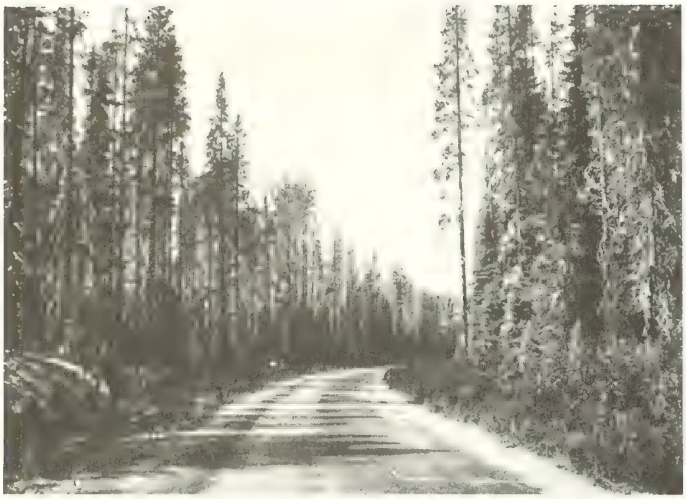


Figure 5-16—Access road through lodgepole pine mostly 7 to 12 inches in d.b.h. at about 4,400 feet elevation just east of Sisi Butte in the Pinhead Butte area of the Mount Hood National Forest.

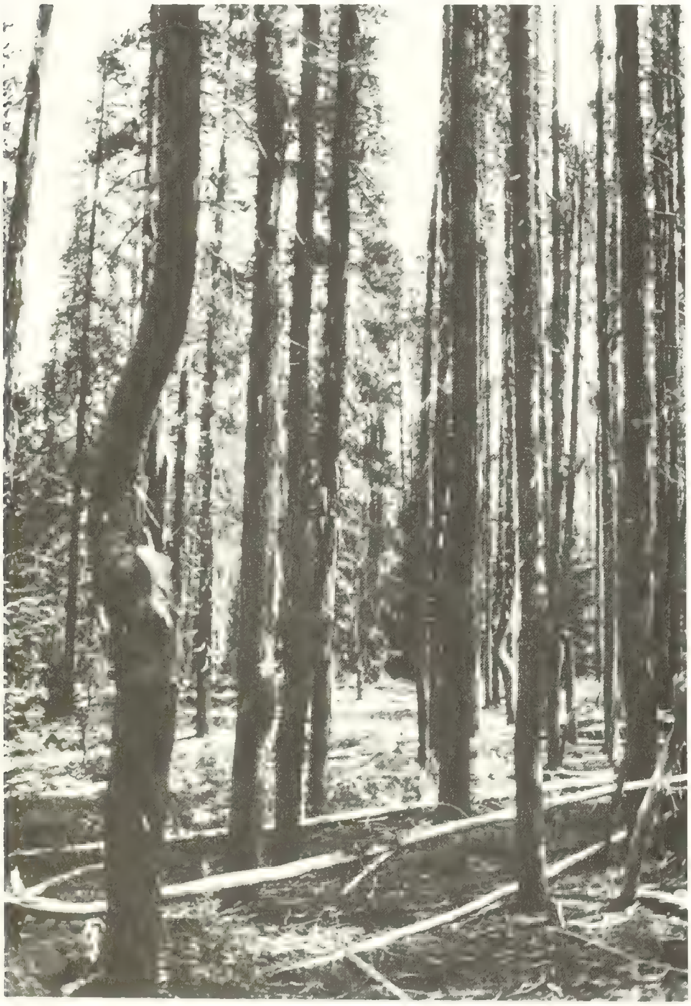


Figure 5-17—Stem crook prevalent in many lodgepole pines found east of Sisi Butte in the Mount Hood National Forest.

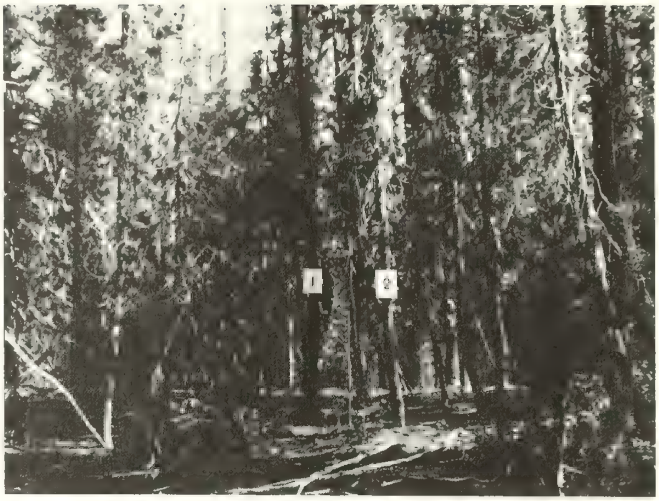


Figure 5-18—Pair of lodgepole pines 3½ to 4 inches in d.b.h. sampled from tall understory of a stand at 4,400 feet east of Sisi Butte in the Mount Hood National Forest.

Characteristic	Tree number 1	Tree number 2
D.b.h. (outside bark), inches	3.80	3.69
Tree height above 6-inch high stump, feet	28.5	28.8
Crown ratio, percent	41.5	71.3
Cone serotiny	no cones	open
Tree age years (number of annual growth rings)		
Stump height	88	88
20 percent of tree height	61	64
Base of live crown	28	57
Diameter inside bark, inches		
Stump height	3.70	3.90
20 percent of tree height	3.43	3.39
Base of live crown	2.29	3.17
Height from stump top to base of live crown, inches	200	99
Stem taper inside bark, inches/100 inches		
Below crown	0.71	0.74
Within crown	1.61	1.29
Rings/inch, average for section		
Stump height	48	45
Base of live crown	24	57
Properties of stemwood at 20 percent height		
Moisture content, percent ovendry weight	78.7	85.9
Specific gravity, ovendry weight and green volume	0.481	0.487
Rings/inch in first 1¼ inches radius	32	26
Maximum crushing strength, lb f/in^2	5,080	5,180
Proportional limit, lb f/in^2	1,860	1,060
Modulus of elasticity, lb f/in^2	800,000	710,000
Compression wood evident?	much	much

Characteristic	Tree number 1	Tree number 2
Spiral grain angle at surface, degrees	1	3
Bark thickness (single), inch	0.14	0.14
Pith eccentricity, inch	0.3	0.5

Inventory Data—Available inventory data do not permit generalization about diameter distributions in the entire area. Limited data on a few acreages where lodgepole pine is growing in more-or-less pure stands follow:

Stand and cell/grid	Average d.b.h.	All live trees of all diameters per acre	Year of stand origin
	Inches	*Number*	
3209			
104/B4	10	209	1930
113/C6	9	331	1930
3210			
125/F3	14	137	1850
3211			
219/B5	5	778	1930

Cubic Yield Potential and Height Growth—Although data are not well documented, area foresters estimate that managed lodgepole pine stands in the area have a realizable potential growth of 50 to 84 ft^3 of stemwood per acre per year. Fifty-foot height growth in managed stands is estimated to be about 50 feet (220 trees per acre, 10 inches in d.b.h. at age 50).

Management Objectives for the Area and Constraints—Much of the area in which lodgepole predominates is so cold in winter that other more-favored species cannot be reliably regenerated. The managers of the area, therefore, would like to accomplish a phased replacement of the present mature and/or stagnated stands with vigorous, new, controlled-density lodgepole pine stands. If timed appropriately, such harvests could enhance wildlife habitat and watershed values. Also, because of proximity to both the Mount Hood and Mount Jefferson recreation areas, visual quality of the landscapes in the area must be protected.

Because of the high value of surrounding timber, weight of distributed residual logging slash is limited to 12 tons per acre (green basis)—less than half the tonnage permitted in the other areas studied.

Other Lodgepole Pine Available in the Area From Public Lands—To the east, the Warm Springs Indian Reservation has considerable acreage of similar lodgepole pine, but its extent and availability were not investigated. To the north, the Bear Springs Ranger District of the Mount Hood National Forest has about 1,200 acres of similar lodgepole pine for which there is little current demand.

Forest Products Industry in the Vicinity—Four sizable sawmills—none of which cut lodgepole pine—are located in the vicinity of Detroit, about 25 miles southwest of the area. West of the area there are sawmills at Estacada and Boring; at the latter location some lodgepole pine cants are processed. Another sawmill cutting random-length dimension lumber is located at the railhead town of Molalla, 96 miles distant. Unlike many of the localities where lodgepole pine grows, Pinhead Butte is less than 100 miles from port facilities and markets for pulp chips.

Population in the Vicinity—Clackamas County had a total population of 248,000 in 1981, at which time the population of Oregon City (the county seat) was 14,920, that of Estacada was 1,755, and that of Molalla was 3,100. In 1985 about 6.5 percent of the workforce in the county was unemployed. Average per-capita income in Clackamas County was $12,924 in 1984.

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Gedney, Donald R. 1982. The timber resources of western Oregon—highlights and statistics. Resour. Bull. PNW-97. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station. 84 p.

CHAPTER 6: UTAH

INTRODUCTION

In Utah, lodgepole pine predominates on about 460,000 acres of the State's 3.2 million acres of commercial forest land, with about 794 million ft^3 of lodgepole pine growing stock and 2.4 billion bd ft of sawtimber (table 6-1). Approximately 22 percent of the softwood growing stock and 16 percent of the softwood sawtimber in the State is lodgepole pine (Van Hooser and Green 1978).

Approximately 50 percent of the dry weight of aboveground biomass in lodgepole pine trees in Utah is in trees smaller than the 10-inch d.b.h. class (table 6-2).

Managers of public forest lands in Utah selected a single case for study—the 16,000-acre Alma Taylor area of the Ashley National Forest (fig. 2-1).

Table 6-1—Volume of lodgepole pine growing stock and sawtimber, and acreage in lodgepole pine, by ownership class, Utah[1]

Ownership class	Growing stock[2]	Sawtimber volume[3]	Commercial timberland area
	Million ft^3	*Million bd ft International ¼-inch scale*	*Thousand acres*
National Forest (commercial)[4]	755.2	2,248.8	424.7
Other public	11.8	37.8	11.0
Forest industry and other private	26.9	83.4	24.7
Total	793.9	2,370.0	[4]460.4

[1] Source: Van Hooser and Green (1983). Information presented is based on 1978 data.

[2] **Growing stock volume** = net volume in cubic feet of live sawtimber and pole timber trees (5 inches d.b.h. and larger) from stump to a minimum 4-inch top outside bark, or to the point where the central stem breaks into limbs.

[3] **Sawtimber volume** = net volume in board feet of the sawlog portion of live sawtimber trees. Sawtimber trees are live trees of commercial species, 9 inches in d.b.h. or larger (softwood), containing at least one 12-foot sawlog or two noncontiguous 8-foot sawlogs, and meeting regional specifications for freedom from defect.

[4] **Commercial timberland** = forest land that is capable of producing crops of industrial wood and not withdrawn from timber utilization by statute or administrative regulation. Areas qualifying as commercial timberland have the capability of producing in excess of 20 ft^3 per acre per year of industrial wood in natural stands.

Table 6-2—Dry weight of lodgepole pine trees, by tree component and diameter class—Utah[1]

Diameter class	Bole[2]	Top[2]	Total
Inches	*Thousand tons, ovendry basis*		
2	—	486	486
4	—	1,669	1,669
6	2,160	1,195	3,355
8	2,304	749	3,053
10	2,212	639	2,851
12	1,606	475	2,081
14	1,367	365	1,732
16	780	196	976
18	409	98	507
20+	373	98	471
Total	11,211	5,970	17,181

[1] Source: Van Hooser and Chojnacky (1983).

[2] **Trees 5+ inches d.b.h.:** Bole weight = ovendry weight of wood and bark from a 1-foot stump to a 4-inch top diameter, inside bark; top weight = ovendry weight of wood and bark from a 4-inch diameter to tip of tree, plus branch material down to ¼-inch diameter.

Trees less than 5 inches d.b.h.: Total ovendry weight of wood and bark from a 1-foot stump to tip of tree, plus branch material down to ¼-inch diameter (tabulated under "Top").

ASHLEY NATIONAL FOREST

Area Name and Location—The Alma Taylor area (figs. 6-1, 6-2, and 6-3), which lies at an elevation of 8,600 to 9,400 feet at latitude 40°38' and longitude 109°41', is in the Vernal Ranger District of the Ashley National Forest; the Ranger Station is in Vernal.

The gross area of 16,000 acres includes about 14,500 acres of lodgepole pine timber type and falls entirely within Uintah County; Vernal is the county seat. The area is centered around Alma Taylor Lake (fig. 6-2) and is 24 air miles due south of the town of Manila on the Wyoming border. It lies 15 air miles northwest of Vernal on a heading of 330°.

Maps of the Area—USGS quadrangle 7½' maps needed to depict the area are: Taylor Mountain and Dry Fork.

Access—From Vernal (5,050 feet in elevation), a paved road leads 21 miles northwest to the forest boundary along Dry Fork of Ashley Creek; all but the last 2 miles are plowed in winter. From the forest boundary it is 10 miles to the area boundary—the first eight gravel and the last two dirt. At this point a dirt access road leads into the area, southeast toward Alma Taylor Lake (figs. 6-2 and 6-4). From this intersection the dirt Red Cloud Loop Road (not plowed in winter) extends about 28 miles north along the west border of the area and beyond, and then east to intersection with U.S Highway No. 191; an additional 20 miles south along the paved highway closes the loop to Vernal.

Via U.S. Highway No. 191, it is 107 miles north from Vernal to the railhead town of Rock Springs, WY. To the west via U.S. Highway No. 40, and 142 miles distant from Vernal, is a railhead near Park City, UT.

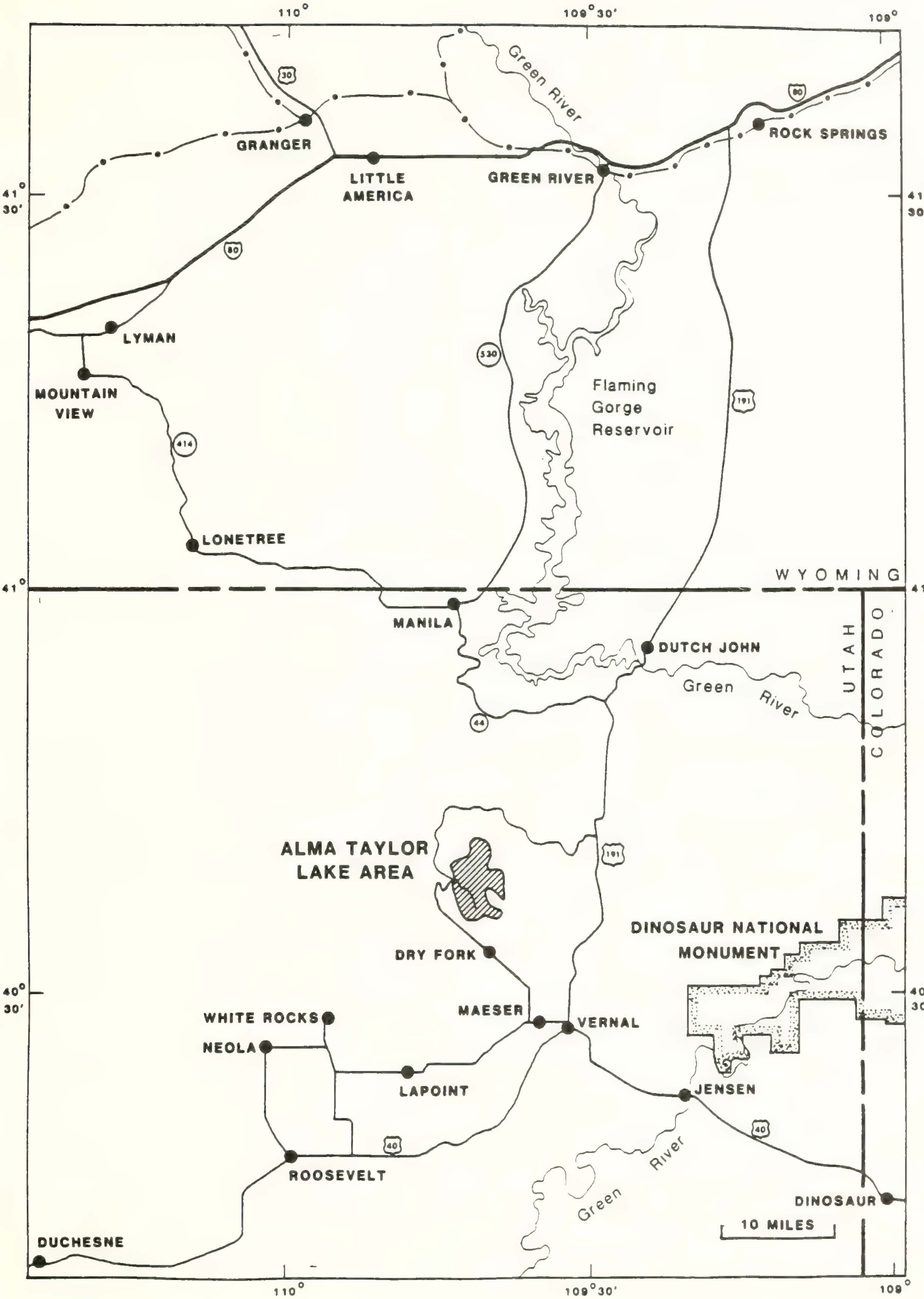

Figure 6-1—Vicinity map for the Alma Taylor area of Ashley National Forest in Utah.

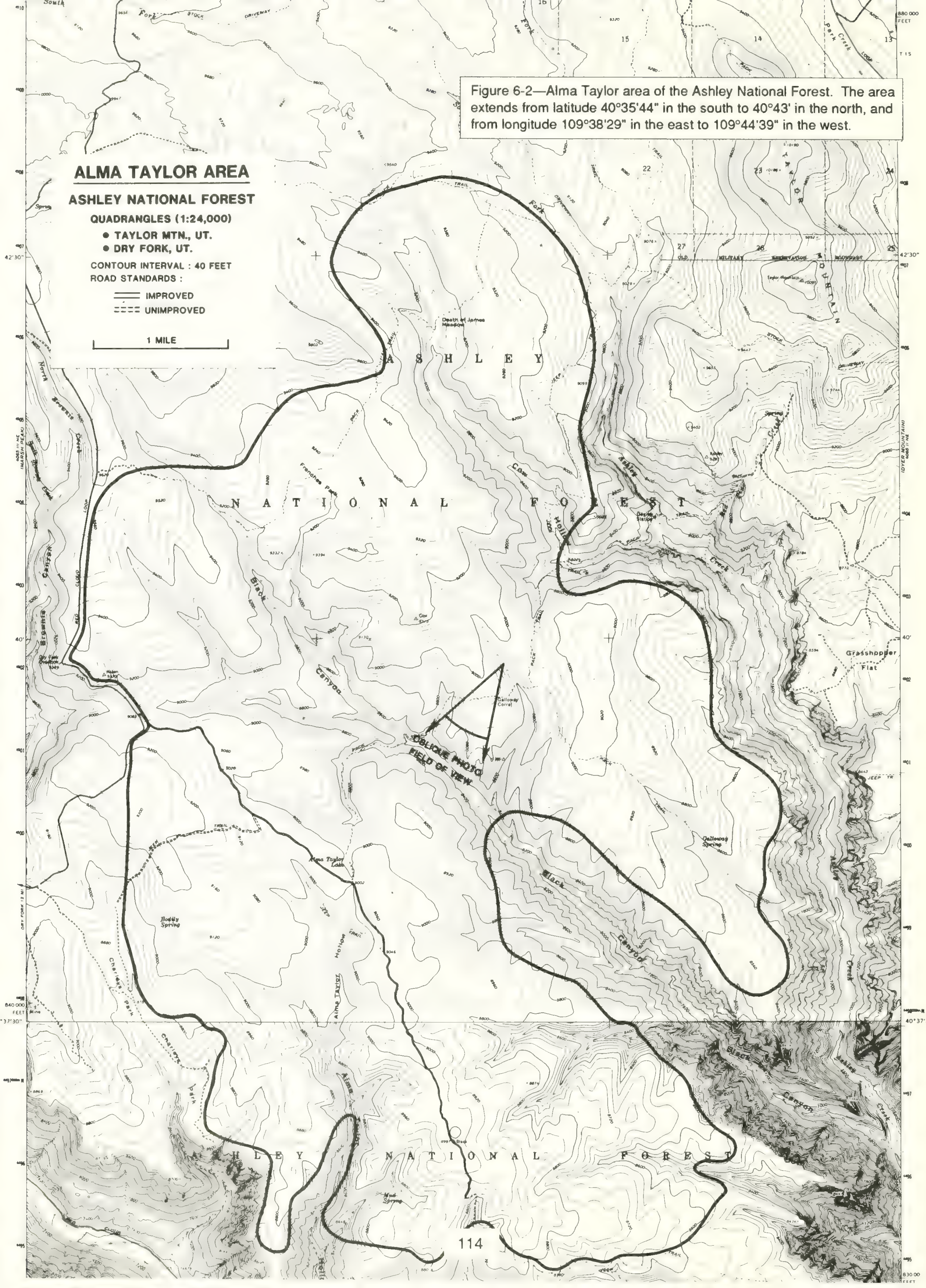

Figure 6-2—Alma Taylor area of the Ashley National Forest. The area extends from latitude 40°35'44" in the south to 40°43' in the north, and from longitude 109°38'29" in the east to 109°44'39" in the west.

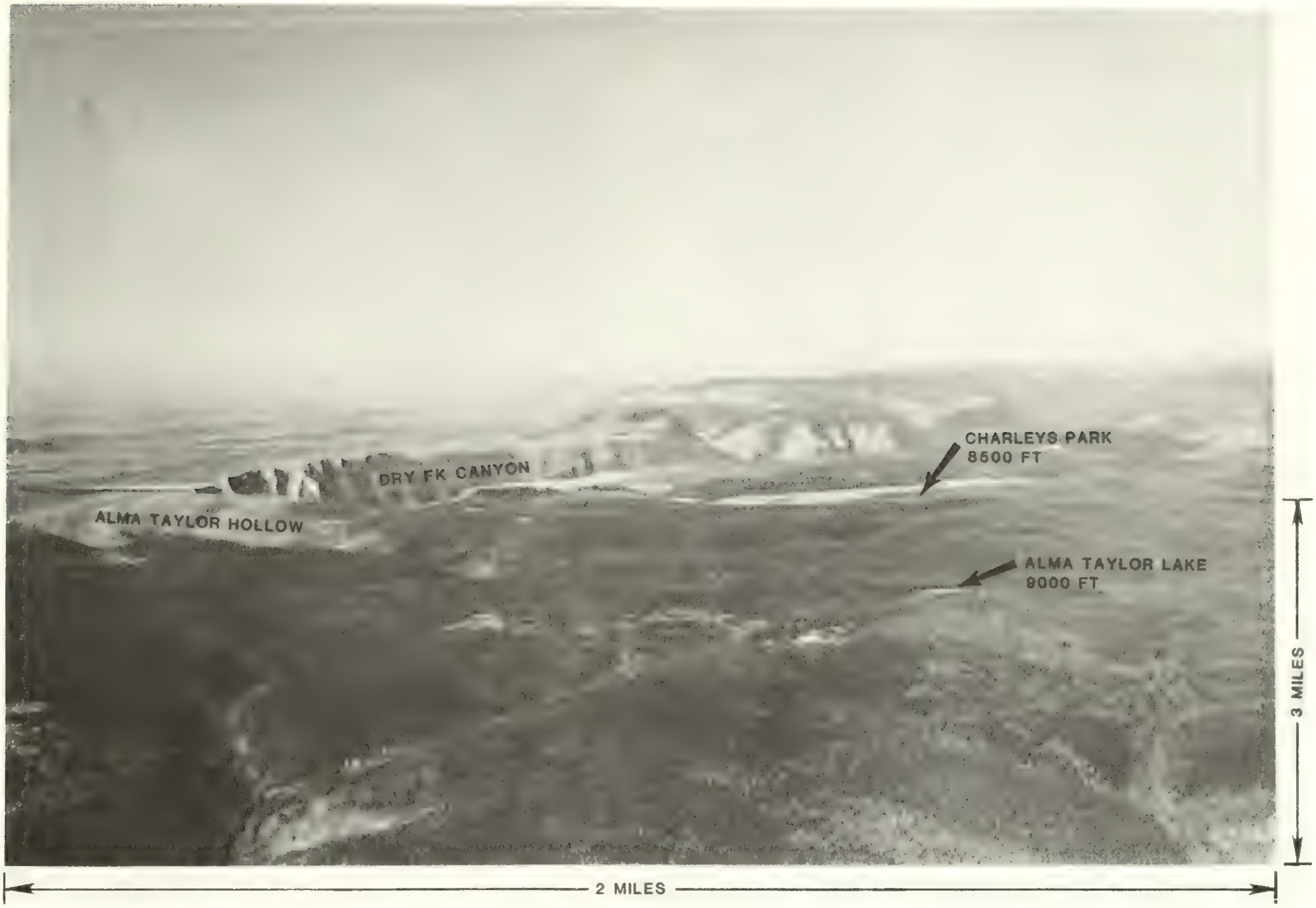

Figure 6-3—Oblique view of the Alma Taylor area looking southwest toward Alma Taylor Lake and Charleys Park. See figure 6-2 for camera viewpoint and field. Width of foreground shown is about 2 miles; from foreground to Charleys Park in the background is about 3 miles.

Figure 6-4—Looking southeast on access road into the Alma Taylor area of the Ashley National Forest from midway along the west border of the area about 2 miles southeast of Dry Fork Overlook; elevation is 9,000 feet.

Highway distance from Vernal to Salt Lake is 171 miles, and to Denver 325 miles. For highway distances from Park City, UT, to various market centers in the United States, see table 1-2; also, under the Bridger-Teton National Forest in table 1-2, mileages from Rock Springs, WY, are shown.

Terrain and Soil—As previously noted, the area lies between 8,600 and 9,400 feet elevation, with about nine-tenths of the area having slopes less than 45 percent. Along the access road from near Dry Fork Overlook to Alma Taylor Lake, the soil has few rocks exposed and is covered by an inch or two of duff (fig. 6-5). Farther east, however, pumpkin-size rocks are extensively distributed on the surface (fig. 6-6). Aside from the scattered rocks, there appear to be no special obstacles to harvesting.

Annual Precipitation and Duration of Snow-free Season—Annual precipitation totals about 25 inches per year. The snow-free season generally extends from mid-June to mid-November.

General Character of the Timber—The timber within the area is primarily subsawlog size. Stands are dense (figs. 6-4, 6-5, and 6-6) and mostly of uniform age (about 80 years). Within the delineated area, mortality from mountain pine beetle is not striking, but outside the area mortality is extensive. Many stands in the area are infested with dwarf mistletoe, but damage from rusts and porcupines is not much in evidence.

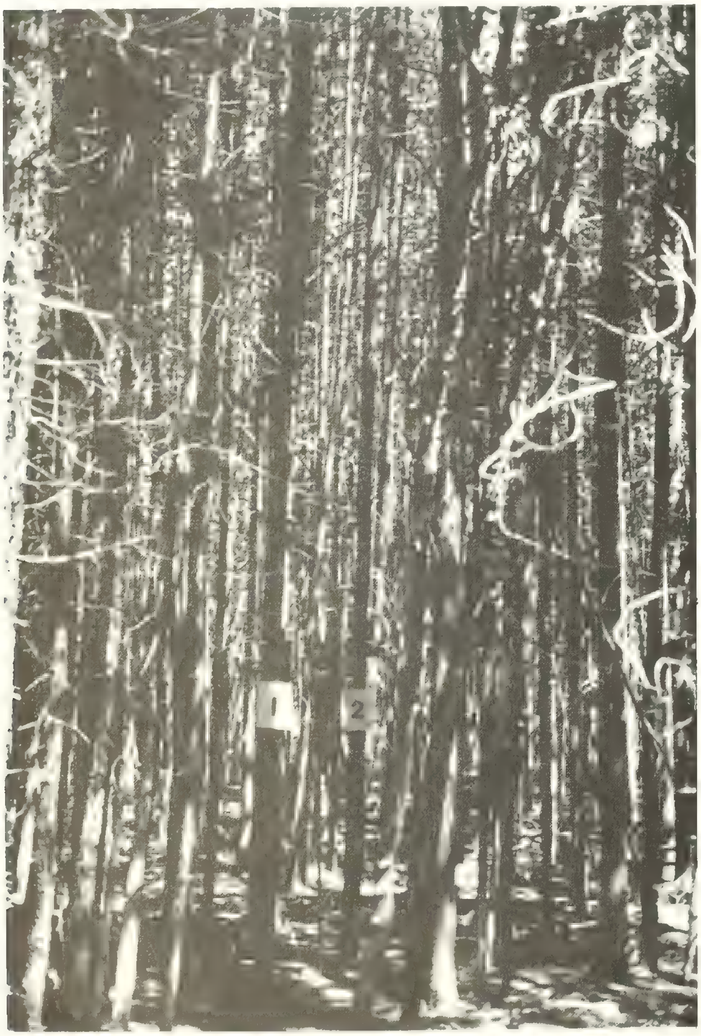

Figure 6-5—Pair of codominant sample lodgepole pines 3½ to 4 inches in d.b.h. at 9,000 feet elevation, about 1 mile northwest of Alma Taylor Lake in the Ashley National Forest.

Harvesting activity north and east of the delineated area has increased in the last few years, and plans call for a continuation of the increased harvest in the future. Within the delineated area there has been little demand for the stumpage, and hence little harvesting.

Data on Sample Trees—A pair of codominant lodgepole pines 3½ to 4 inches in d.b.h. were destructively sampled from level terrain at 9,000 feet elevation about 1 mile northwest of Alma Taylor Lake (fig. 6-5). Some pertinent tree characteristics follow. These tabulated data should not be interpreted as statistically representative of all trees.

See appendix for an explanation of tree selection and evaluation of mechanical properties in compression parallel to the grain at 10 percent moisture content.

Characteristic	Tree number 1	Tree number 2
D.b.h. (outside bark), inches	3.97	3.86
Tree height above 6-inch high stump, feet	41.0	36.5
Crown ratio, percent	32.9	34.3
Cone serotiny	closed	closed
Tree age years (number of annual growth rings)		
Stump height	83	85
20 percent of tree height	79	72
Base of live crown	35	38
Diameter inside bark, inches		
Stump height	4.02	3.90
20 percent of tree height	3.49	3.47
Base of live crown	2.31	2.32
Height from stump top to base of crown, inches	330	288

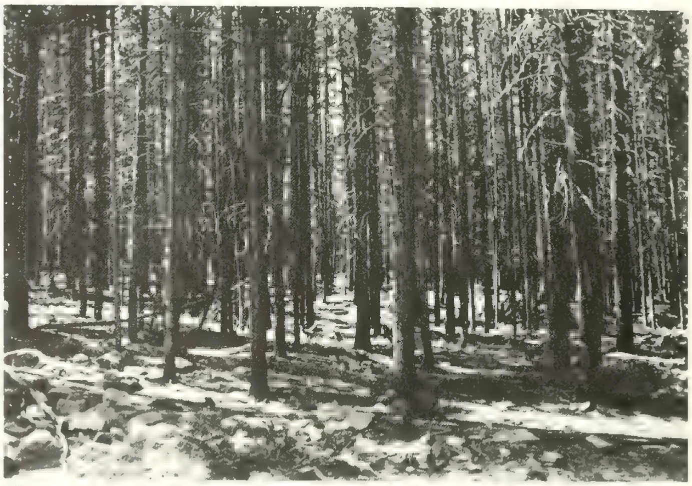

Figure 6-6—Rock-strewn forest floor typical of some lodgepole stands in the Alma Taylor area of the Ashley National Forest.

Characteristic	Tree number 1	Tree number 2
Stem taper inside bark, inches/100 inches		
Below crown	0.52	0.55
Within crown	1.43	1.55
Rings/inch, average for section		
Stump height	41	44
Base of live crown	30	33
Properties of stemwood at 20 percent height		
Moisture content, percent ovendry weight	100.0	110.1
Specific gravity, ovendry weight and green volume	0.369	0.365
Rings/inch in first 1¼ inches radius	46	24
Maximum compresssive strength, lb f/in²	5,060	5,190
Proportional limit, lb f/in²	2,810	3,950
Modulus of elasticity, lb f/in²	1,060,000	970,000
Compression wood evident?	none	none
Spiral grain angle at surface, degrees	1	3
Bark thickness (single), inch	0.11	0.10
Pith eccentricity, inch	0.2	0.1

Inventory Data—Inventory data on the area are incomplete. As previously mentioned, most of the stands within the delineated area contain subsawlog-size trees. Of the 14,500 acres of lodgepole pine timber type, approximately 80 percent of the acreage resembles stands depicted in figures 6-5 and 6-6. Managers familiar with the area suggest that diameter distribution on such acreage averages about as follows:

D.b.h. class	Number of live trees per acre
Inches	
<2.9	500
3.0-3.9	350
4.0-4.9	300
5.0-5.9	200
6.0-6.9	150
7.0-7.9	20
8.0-8.9	10
9.0+	10
Total	1,540

Cubic Yield Potential and Height Growth—Although data are not well documented, area managers estimate that the current lodgepole pine forests in the delineated area are growing at 20 to 25 ft³ per acre per year; the potential in managed stands is estimated at 50 ft³ per acre per year. Fifty-year height growth in managed stands is estimated to be 30 to 35 feet.

Management Objectives for the Area and Constraints—Because of stagnant stand growth and heavy mountain pine beetle attacks in adjacent stands, a primary management objective is phased harvest and replacement with vigorous, new, controlled-density lodgepole pine stands less susceptible to attack. The harvests must be timed to enhance wildlife habitat and protect watershed and recreational values.

The major deterrent is lack of stumpage markets. Stumpage for firewood (not a large market) sells for about $5 per cord. On acreages within the area that have sawlog-size timber, stumpage might sell for $1 to $12 per M bd ft Scribner scale—a price that does not completely cover the total cost of preparing small-acreage, low-volume sales.

Road costs are unexpectedly higher because road cuts are not called for on level ground typical of the area. Therefore gravel fill must be hauled in.

Other Lodgepole Pine Available in the Area From Public Lands—On the entire Ashley National Forest there are about 240,000 acres of lodgepole pine timber type (including the 14,500 acres within the Alma Taylor area). Of this total, the Forest Plan calls for stand replacement on about 1,100 acres per year in addition to 1,000 to 1,500 acres per year scheduled for harvest through conventional timber sales. A high proportion of the acres scheduled for stand replacement or harvest are on slopes less than 45 percent.

Forest Products Industry in the Vicinity—Within a few miles of Vernal there are two small sawmills cutting 1 or 2 million bd ft annually, and another very small mill in Neola west of Vernal. Somewhat larger sawmills operate in Lapoint (also west of Vernal), and in Mountain View, northwest of Manila near I-80.

Producers of roundwood products operate in Manila and in Lapoint, the latter making house logs. There is no market for pulp chips within economic haul distance.

Population in the Vicinity—In 1980 Uintah County had a total population of 20,506. Vernal, the county seat, has a population (1986) of about 6,600. In 1985 the per-capita income in Uintah County was $8,984, with 8.5 percent of the workforce unemployed.

REFERENCES

Van Hooser, Dwane D.; Chojnacky, David C. 1983. Whole tree volume estimates for the Rocky Mountain States. Resour. Bull. INT-29. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 69 p.

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CHAPTER 7: WASHINGTON

INTRODUCTION

In Washington, lodgepole pine predominates on about 770,000 acres of the State's 17.4 million acres of commercial forest land, with about 1.8 billion ft^3 of lodgepole pine growing stock and 5.2 billion bd ft of sawtimber (table 7-1). Approximately 3 percent of the softwood growing stock and 2 percent of the softwood sawtimber in the State is lodgepole pine (Bassett and Oswald 1981a, 1981b, 1982, 1983).

Approximately 42 percent of the lodgepole pine growing stock in Washington is in trees smaller than the 10-inch d.b.h. class (table 7-2).

Managers of public forest land in Washington selected for study four areas (fig. 7-1) totaling 133,120 acres in gross area. The study areas are individually described in the following text.

Table 7-1—Volume of lodgepole pine growing stock and sawtimber, and acreage in lodgepole pine, by ownership class, Washington[1]

Ownership class	Growing stock[2]	Sawtimber volume[3]	Commercial timberland area
	Million ft^3	*Million bd ft International 1/4-inch scale*	*Thousand acres*
National Forest (commercial)[4]	769	1,914	411
Other public	545	1,847	190
Forest industry	165	618	43
Other private	280	807	128
Total	1,759	5,186	[4]772

[1] Sources: Bassett and Oswald (1981a, 1981b, 1982, 1983).

[2] **Growing stock volume** = net volume in cubic feet of live sawtimber and pole timber trees (5 inches d.b.h. and larger) from stump to a minimum 4-inch top outside bark, or to the point where the central stem breaks into limbs.

[3] **Sawtimber volume** = net volume in board feet of the sawlog portion of live sawtimber trees. Sawtimber trees are live trees of commercial species, 9 inches in d.b.h. or larger (softwood), containing at least one 12-foot sawlog or two noncontiguous 8-foot sawlogs, and meeting regional specifications for freedom from defect.

[4] **Commercial timberland** = forest land that is capable of producing crops of industrial wood and not withdrawn from timber utilization by statute or administrative regulation. Areas qualifying as commercial timberland have the capability of producing in excess of 20 ft^3 per acre per year of industrial wood in natural stands.

Table 7-2—Distribution of lodgepole pine growing stock cubic volume by diameter class—Washington[1]

Diameter class	Volume of growing stock[2]		
	Eastern Washington[3]	Western Washington[3]	Total
Inches	*Million ft^3*		
6	264	14	278
8	440	24	464
10	326	27	353
12	227	34	261
14	139	22	161
16	80	17	97
18	55	13	68
20	37	2	39
22-28	27	4	31
29+	6	—	6
Total	1,601	157	1,758

[1] Sources: Bassett and Oswald (1981a, 1981b, 1982, 1983).

[2] **Growing stock volume** = net volume in cubic feet of live sawtimber and pole timber trees (5 inches d.b.h. and larger) from stump to a minimum 4-inch top outside bark, or to the point where the central stem breaks into limbs.

[3] Eastern Washington = area east of crest of Cascade Range; western Washington = area west of crest of Cascade Range.

COLVILLE NATIONAL FOREST

Area Name and Location—The Pend Oreille-Ruby Creek area (figs. 7-2, 7-3, and 7-4), which lies at an elevation of 2,800 to 5,200 feet at latitude 48°35' and longitude 117°26', is in three Ranger Districts (Newport, 5,000 acres; Colville, 15,000 acres; and Sullivan Lake, 20,000 acres) of the Colville National Forest. The Newport Ranger Station is in Newport, which is also the county seat of Pend Oreille County in which the entire area is located.

The gross area of about 40,000 acres includes about 14,000 acres on which lodgepole pine predominates, and 16,000 acres of lodgepole pine mixed with western larch; on the balance of the acreage, larch predominates. The area is centered around Ruby Creek and the south fork of Lost Creek (fig. 7-3). The center of the southern end of the area is 21 air miles due east of Colville. The north border of the area is 7 air miles due south of Ione. At closest proximity, the Pend Oreille River passes within 1 mile of the eastern border of the area.

Maps of the Area—USGS quadrangle 7½' maps needed to depict the area are: Aladdin Mountain, Ione, Lake Gillette, and Timber Mountain.

WASHINGTON

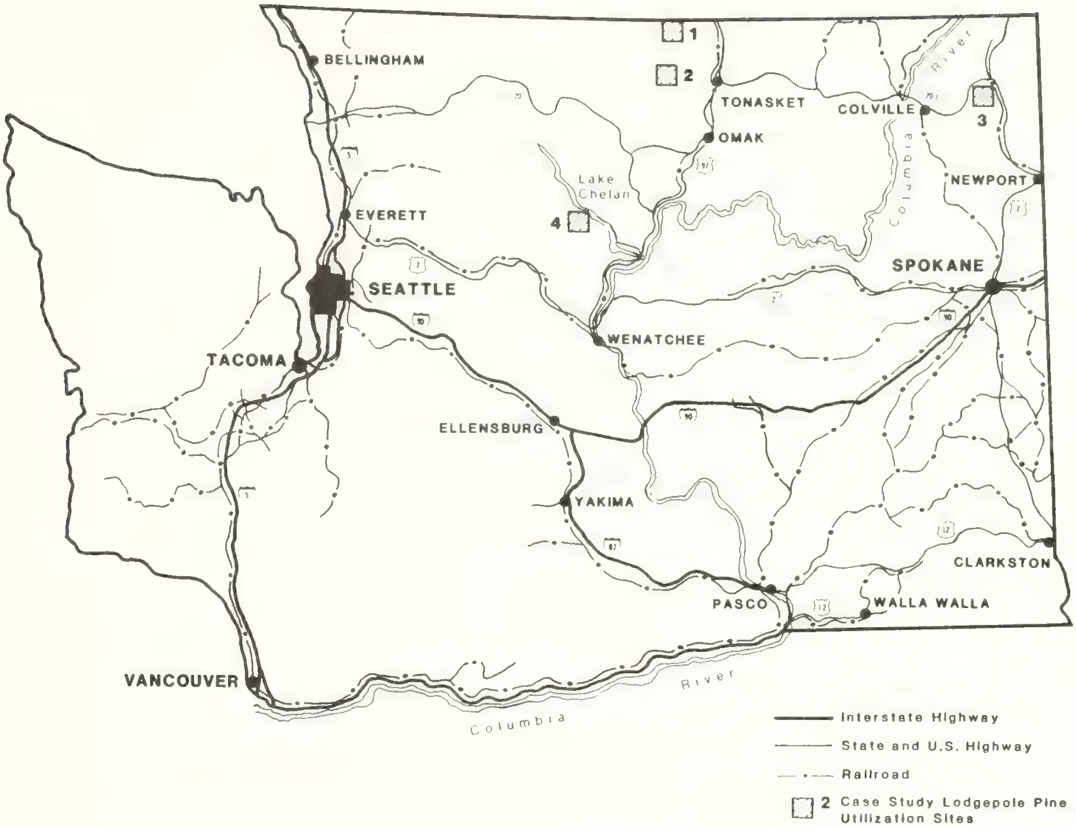

Figure 7-1—Washington location map. 1. State Forest (Loomis Block) 2,120 acres. 2. Okanogan NF (Meadows) 89,000 acres. 3. Colville NF (Pend Oreille-Ruby Creek) 40,000 acres. 4. Wenatchee NF (Big Creek-Lake Creek) 2,000 acres.

Access—From Blue Slide, WA (2,060 feet in elevation and about 38 miles northwest of Newport via State Highway No. 20), an improved road leads west up Ruby Creek 3½ miles to the east border of the area and on west to the confluence of Little Ruby Creek and Ruby Creek. From this point a gravel road leads north to Rufus Meadows, which lies at an elevation of 4,100 feet; road distance from Rufus Meadows to Newport is 50 miles. Farther west within the area, a gravel road (Tacoma Divide Road) runs north the full length of the area, connecting with State Highway No. 20 just north of the Little Pend Oreille River. Also, there is road access to the southeast quadrant of the area, and to the east-central portion (fig. 7-3).

The nearest railhead is at Blue Slide (or possibly Cusick, which is 18 miles northwest of Newport) on the Pend Oreille Valley line from Metaline Falls to Newport. For highway distances from Cusick to various market centers in the United States, see table 1-2.

Terrain and Soil—As previously noted, the area lies between 2,800 and 5,200 feet elevation, with about two-thirds of the acreage having slopes in excess of 25 percent; about 10 percent of the acres have slopes of more than 45 percent, but none exceed 55 percent.

In most areas glacial till soils are overlayed with 16 to 28 inches of volcanic ash. Along Ruby Creek deep sands are encountered.

Annual Precipitation and Duration of Snow-free Season—Annual precipitation totals 35 to 40 inches, with most falling as snow. The snow-free season generally extends from late May through October.

General Character of the Timber—The timber is characterized by an overstory of 300 to 550 lodgepole pine and/or larch trees per acre measuring 4 to 6 inches in d.b.h., and a several-thousand-stem per acre understory of mixed conifers measuring about 2 inches in d.b.h. (figs. 7-5 and 7-6). The overstory is 50 to 60 feet high and the understory 6 to 24 feet high. Overstory trees average about 65 years old.

Currently, mountain pine beetle attacks are minor, as are attacks by western gall rust. Porcupine damage is

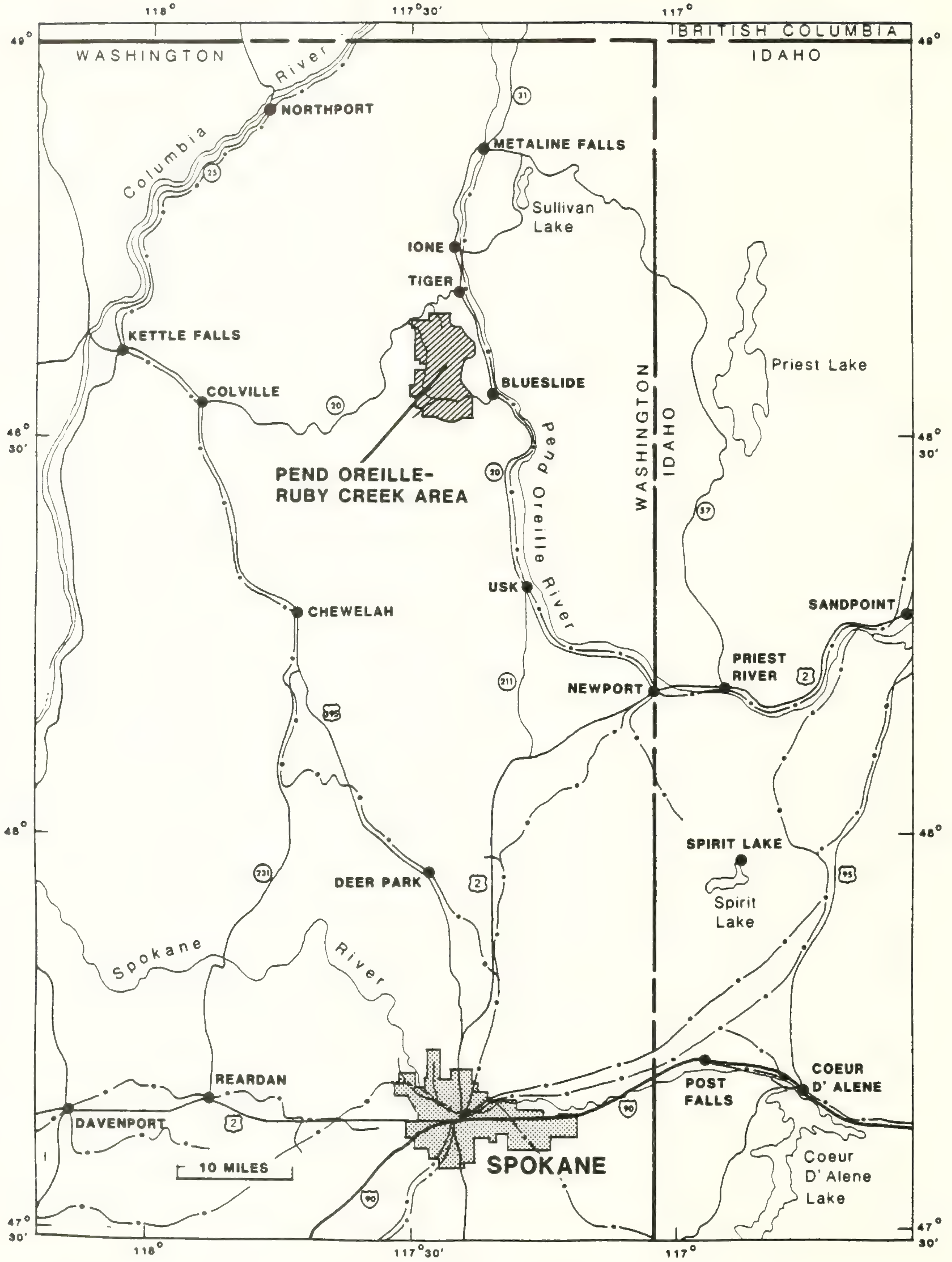

Figure 7-2—Vicinity map for the Pend Oreille-Ruby Creek area of the Colville National Forest in Washington.

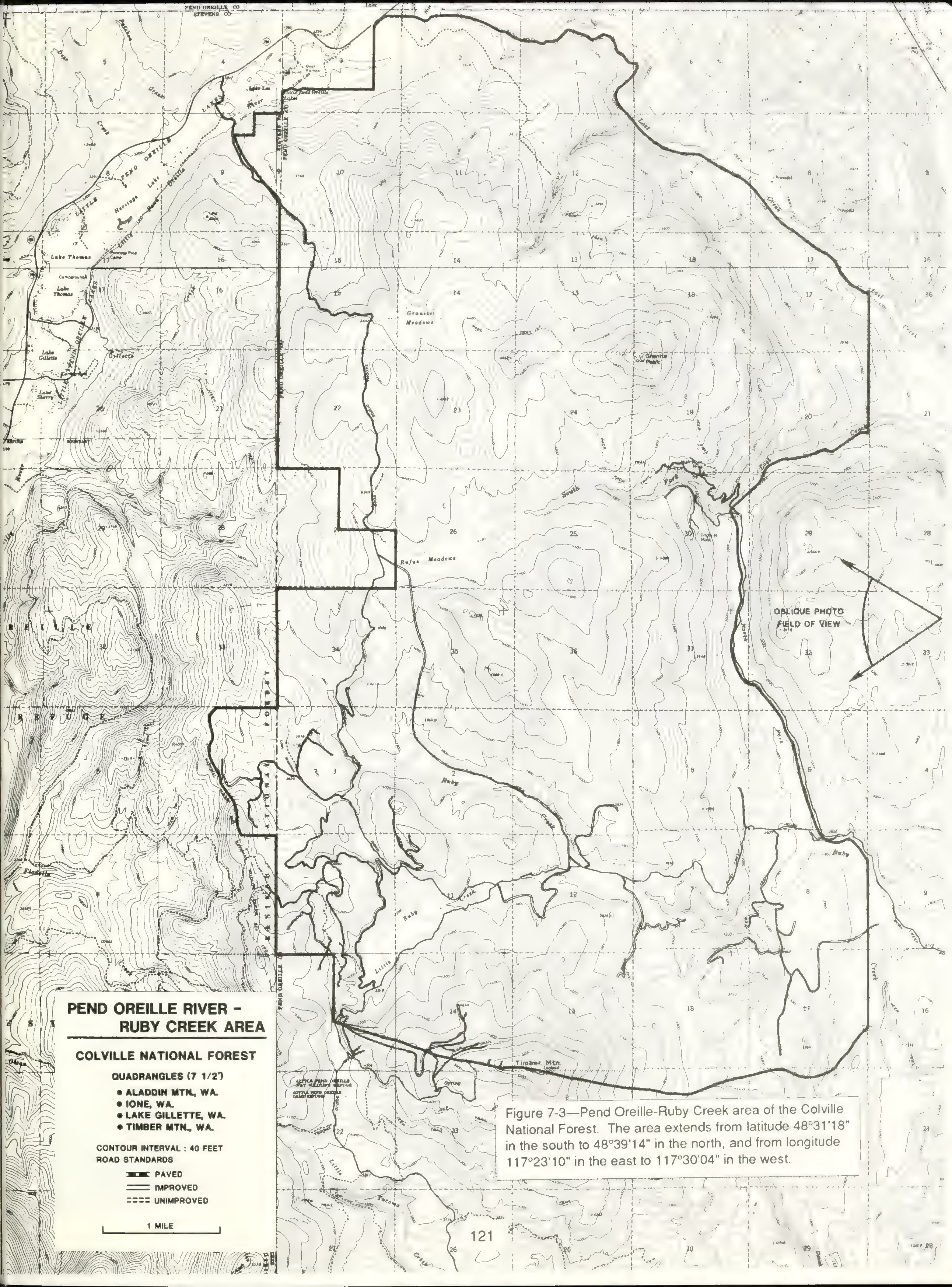

Figure 7-3—Pend Oreille-Ruby Creek area of the Colville National Forest. The area extends from latitude 48°31'18" in the south to 48°39'14" in the north, and from longitude 117°23'10" in the east to 117°30'04" in the west.

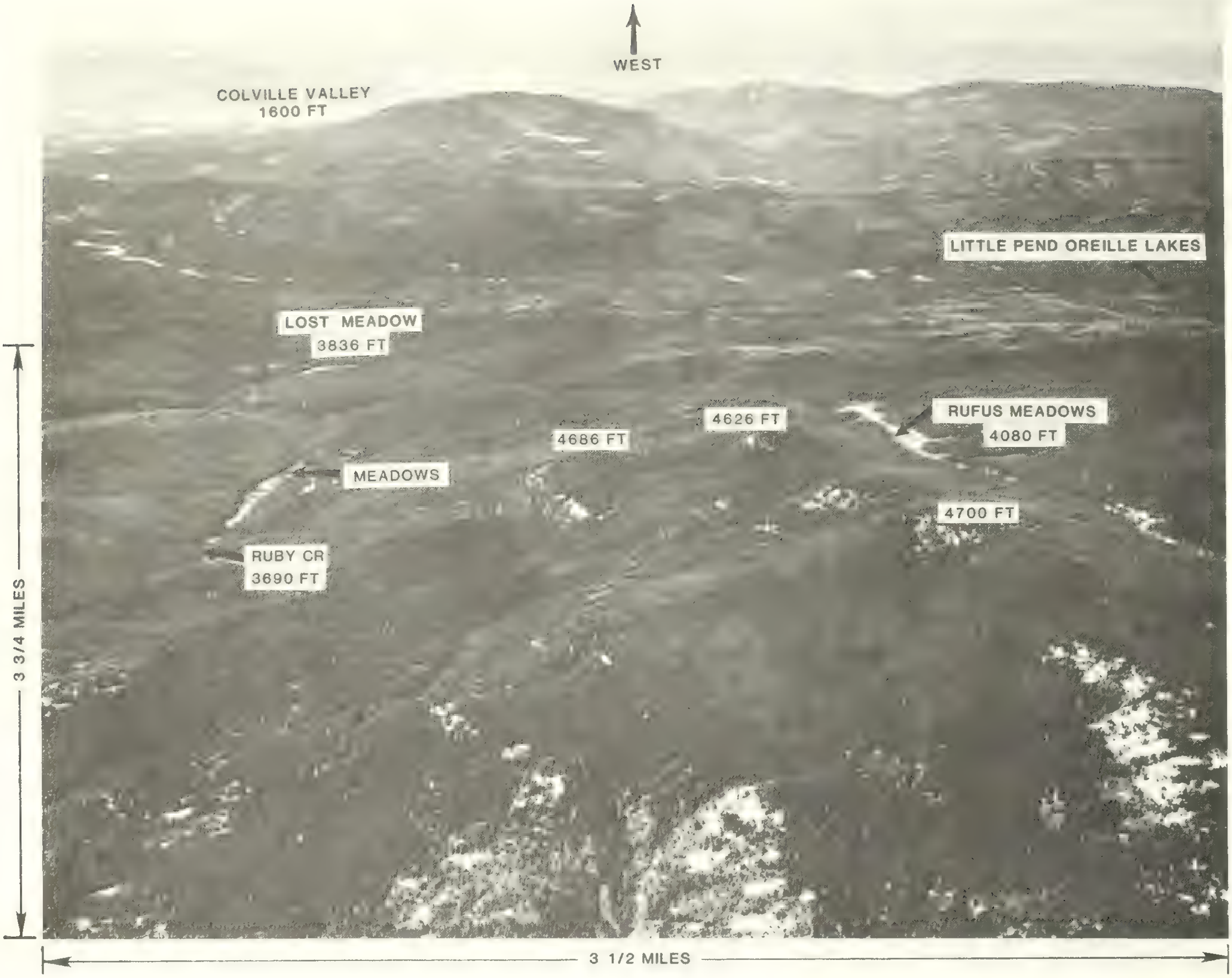

Figure 7-4—Oblique view of the Pend Oreille-Ruby Creek area looking west across it toward the Colville Valley and the Little Pend Oreille Lakes. See figure 7-3 for camera viewpoint and field. Width of foreground shown is about 3½ miles; from the foreground to the west border of the area by Lost Meadow is about 3¾ miles.

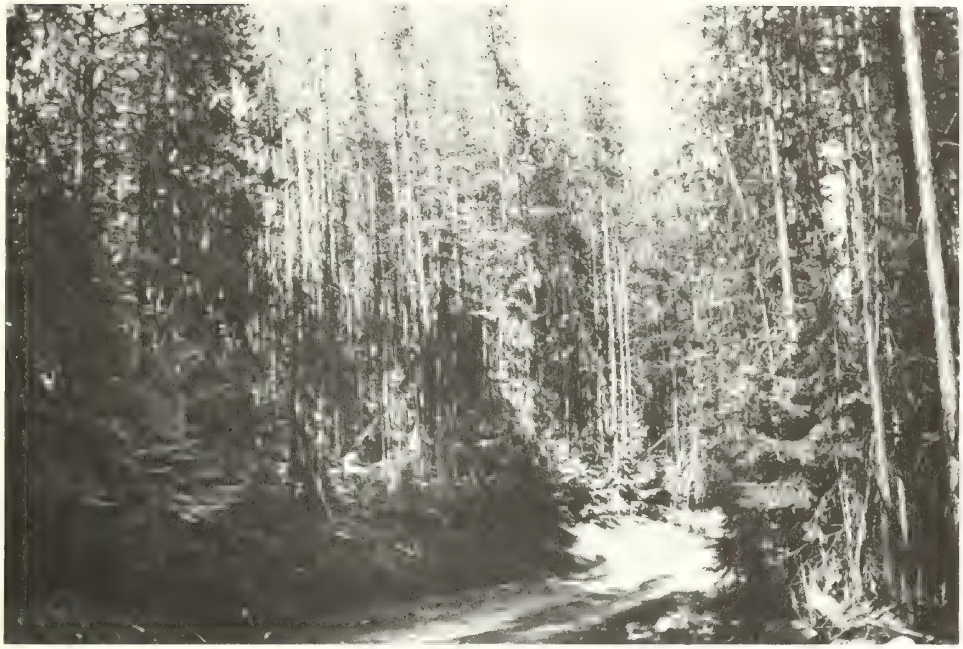

Figure 7-5—Lodgepole pine overstory and mixed-conifer understory along access road between Rufus Meadows and the confluence of Ruby Creek and Little Ruby Creek in the Colville National Forest, at elevation of 3,600 feet.

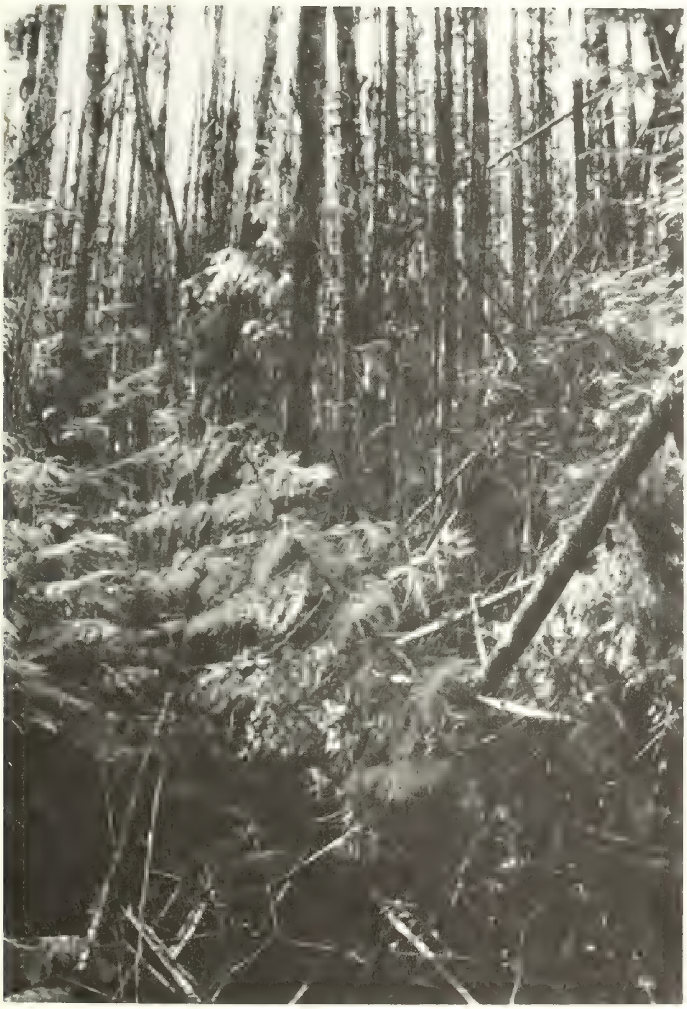

Figure 7-6—Mixed-conifer dense understory below an overstory of lodgepole pine and larch south of Rufus Meadows in the Colville National Forest.

slight, and dwarf mistletoe infestation is not a serious problem. Willow growth can stifle seedlings if harvested areas are not promptly regenerated and vegetation managed.

In years past, about 1,000 acres have been harvested for pulpwood and small sawlogs. Currently, about 100 acres are harvested annually for these products.

Data on Sample Trees—A pair of adjacent lodgepole pines (and a nearby larch) measuring $3^{1}/_{2}$ to 4 inches in d.b.h. were destructively sampled from the edge of a stand about a mile south of Rufus Meadows at about 4,000 feet elevation.

The larch was 44 years old at the stump, 37 feet tall, and 4 inches in d.b.h., with stemwood moisture content and specific gravity at 20 percent of tree height measuring 86.6 percent of ovendry weight and 0.443 (based on ovendry weight and green volume), respectively. Its crown ratio was 55.9 percent and it had inside-bark stem taper below the crown of 0.56 inch per 100 inches. A pith-centered $2^{1}/_{4}$-inch-diameter dowel turned from a 9-inch-long stem section taken at 20 percent of tree height had modulus of elasticity of 1,480,000 lb f/in^2 and maximum crushing strength parallel to the grain of 6,900 lb f/in^2 (both values adjusted to a specimen moisture content of 10 percent).

Some pertinent characteristics of the lodgepole pine trees sampled follow. These tabulated data should not be interpreted as representative of all the overstory trees, particularly because these two were sampled at the edge of a stand where they had little competition and grew more rapidly than more characteristic overstory trees within stands.

See appendix for an explanation of tree selection and procedures for evaluation of mechanical properties in compression parallel to the grain at 10 percent moisture content.

Characteristic	Tree number 1	Tree number 2
D.b.h. (outside bark), inches	3.80	3.50
Tree height above 6-inch high stump, feet	34.3	33.7
Crown ratio, percent	70.1	62.1
Cone serotiny	open	open
Tree age years (number of annual growth rings)		
Stump height	24	29
20 percent of tree height	16	19
Base of live crown	12	16
Diameter inside bark, inches		
Stump height	3.82	3.35
20 percent of tree height	3.75	3.08
Base of live crown	3.01	2.78
Height from stump top to base of crown, inches	123	153
Stem taper inside bark, inches/100 inches		
Below crown	0.66	0.37
Within crown	1.05	1.20
Rings/inch, average for section		
Stump height	13	17
Base of live crown	8	12
Properties of stemwood at 20 percent height		
Moisture content, percent ovendry weight	157.6	133.0
Specific gravity, ovendry weight and green volume	0.359	0.387
Rings/inch in first $1^{1}/_{4}$ inches radius	10	13
Maximum crushing strength, lb f/in^2	4,280	5,350
Proportional limit, lb f/in^2	3,110	4,110
Modulus of elasticity, lb f/in^2	960,000	1,130,000
Compression wood evident?	none	none
Spiral grain angle at surface, degrees	0	0
Bark thickness (single), inch	0.12	0.14
Pith eccentricity, inch	0.1	0.2

Inventory Data—Inventory data on the area are minimal. See comments under the paragraph heading "General Character of the Timber."

Cubic Yield Potential and Height Growth—Although data are not well documented, managers responsible for the area estimate that lodgepole pines in managed stands should average 1 inch of radius growth per decade, and grow 50 to 120 ft^3 of stemwood per acre per year. Fifty-year height growth in managed stands is estimated to be 60 to 80 feet.

Management Objectives for the Area and Constraints—The area has the potential for relatively high productivity if brought under management. The primary objective, therefore, is phased harvest of both understory and overstory and replacement with vigorous, new, controlled-density stands containing a mixture of coniferous species—including lodgepole pine—with intention of establishing a rotation of about 70 years. If properly timed, such harvests can enhance wildlife habitat and protect watershed values.

The obstacle to achieving the objectives is inability to market the stumpage at a price sufficient to pay the costs of stand replacement. In the absence of harvest, the forest managers have experimented with a number of ways of destroying the stands and replacing them as described above. On slopes amenable to mobile machinery, significant acreage has been trampled without prior harvest, burned to kill advanced regeneration and to prepare the site for planting, and hand-planted with bare-root seedlings comprising a mixture of coniferous species (fig. 7-7). As funds are available, additional acreages will be so treated in the future.

Such machine trampling is not possible, however, on those portions of the area that have slopes in excess of about 25 percent.

Other Lodgepole Pine Available in the Area From Public Lands—On the entire Colville National Forest there are an additional 160,000 acres of more-or-less stagnated lodgepole pine for which the managers have no present substantial market at a stumpage price adequate to pay for stand replacement.

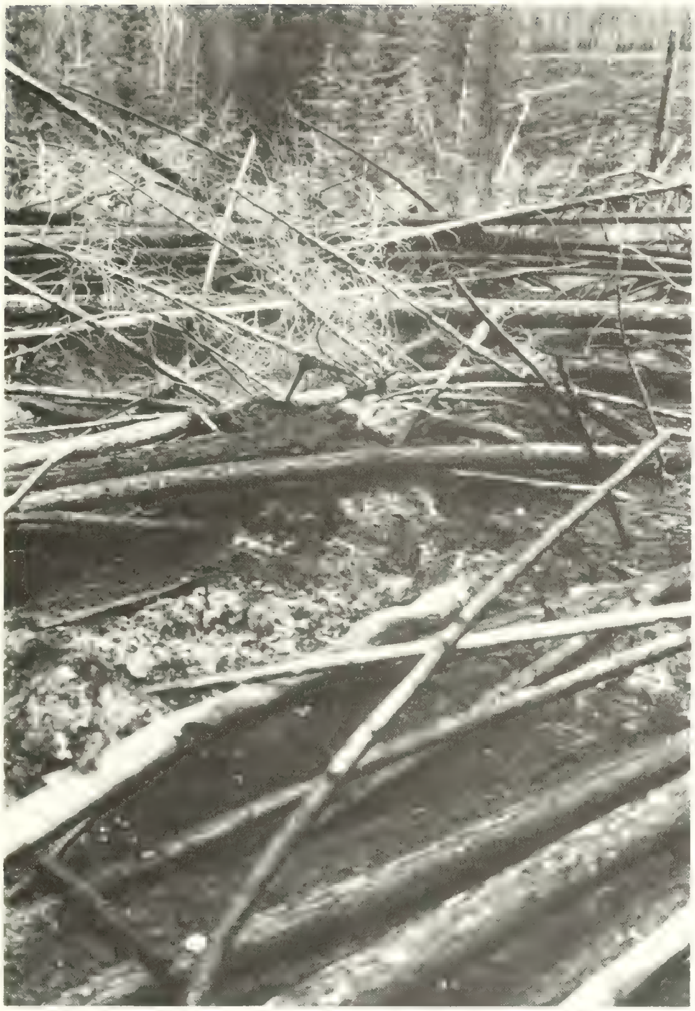

Figure 7-7—Acreage south of Rufus Meadows in the Colville National Forest on which, without prior harvest, the stagnated stand has been trampled, burned, and hand-planted with bare-root seedlings. A seedling is visible in the center of the photo.

Forest Products Industry in the Vicinity—In Ione, just north of the area, there is a sizable sawmill cutting random-length dimension lumber from a variety of species. To the south, in Usk, there is a plant producing lodgepole pine pulp chips—and also near Usk, a facility to manufacture thermomechanical newsprint is under construction. A sawmill (presently closed) capable of cutting metric sizes of lumber is located in Newport. Also, there is a post-and-pole plant in Newport. Farther east, large sawmills cutting dimension lumber are located in Priest River and Sandpoint, ID.

To the west there is a plywood plant and a chip-fired power plant in Kettle Falls. And several large sawmills are located in the Colville-Addy-Chewelah vicinity. Few, if any, of these sawmills have use for subsawlog-size lodgepole pine. The pulp plant will, however.

House log manufacturers are located just west of Newport and in Priest River. A Spokane plant manufactures newsprint, but not from lodgepole pine.

Population in the Vicinity—The total population of Pend Oreille County was 9,100 in 1984. Newport, the county seat, has a population of 1,500. The settlements of Cusick and Blue Slide, both along the railroad east of the area, have populations of only a few.

Per-capita income in Pend Oreille County averaged $6,959 in 1981. During 1985, 15.3 percent of those in the workforce were unemployed.

OKANOGAN NATIONAL FOREST

Area Name and Location—The Meadows area (figs. 7-8, 7-9, and 7-10), which lies at an elevation of 4,500 to 8,242 feet at latitude 48°42' and longitude 119°57', is in the Tonasket and Winthrop Ranger Districts of the Okanogan National Forest; the Ranger Stations are in Tonasket and Winthrop, respectively.

The gross area of about 89,000 acres is about 81 percent timbered, and includes about 48,000 acres of lodgepole pine timber type. It lies entirely within Okanogan County; the town of Okanogan is the county seat. The area extends north and south between Long Swamp Campground in the north and Granite Mountain in the south (fig. 7-9). The north edge of the area lies 6 air miles south of the Canadian border, and about 14 miles due west of Palmer Lake. The town of Loomis is 14 air miles due east of the middle of the north half of the area, and Conconully is 10 miles due east of the center of the south end of the area.

Maps of the Area—USGS quadrangle maps (all metric) needed to depict the area are: Robinson Mountain, Oroville, Twisp, and Omak.

Access—A paved road runs 21 miles west from Loomis (1,310 feet) to Long Swamp Campground (about 5,500 feet). From Long Swamp Campground a gravel road extends south through most of the length of the area, connects with an improved road to Conconully (fig. 7-9), and hence to Omak and Tonasket (903 feet) on the Okanogan River. Tonasket is about 18 miles southeast of Loomis, and 24 miles north of Omak.

Omak, on the Burlington Northern line from Oroville to Wenatchee, is a nearby railhead. For highway distances from Omak to various market centers in the United States, see table 1-2.

Terrain and Soil—The timbered area lies primarily between 4,500 feet and 7,000 feet, with two-thirds of the area having slopes less than 36 percent. Soils are of granitic origin and do not have the volcanic ash overlay common on the Colville National Forest to the east. The ground does not appear excessively stony or rocky (figs. 7-10 and 7-11), and there appear to be no special obstacles to harvesting.

Annual Precipitation and Duration of Snow-free Season—Annual precipitation averages 40 to 45 inches, with heavy snow accumulation usual in winter. The snow-free season generally extends from June 1 to mid-September.

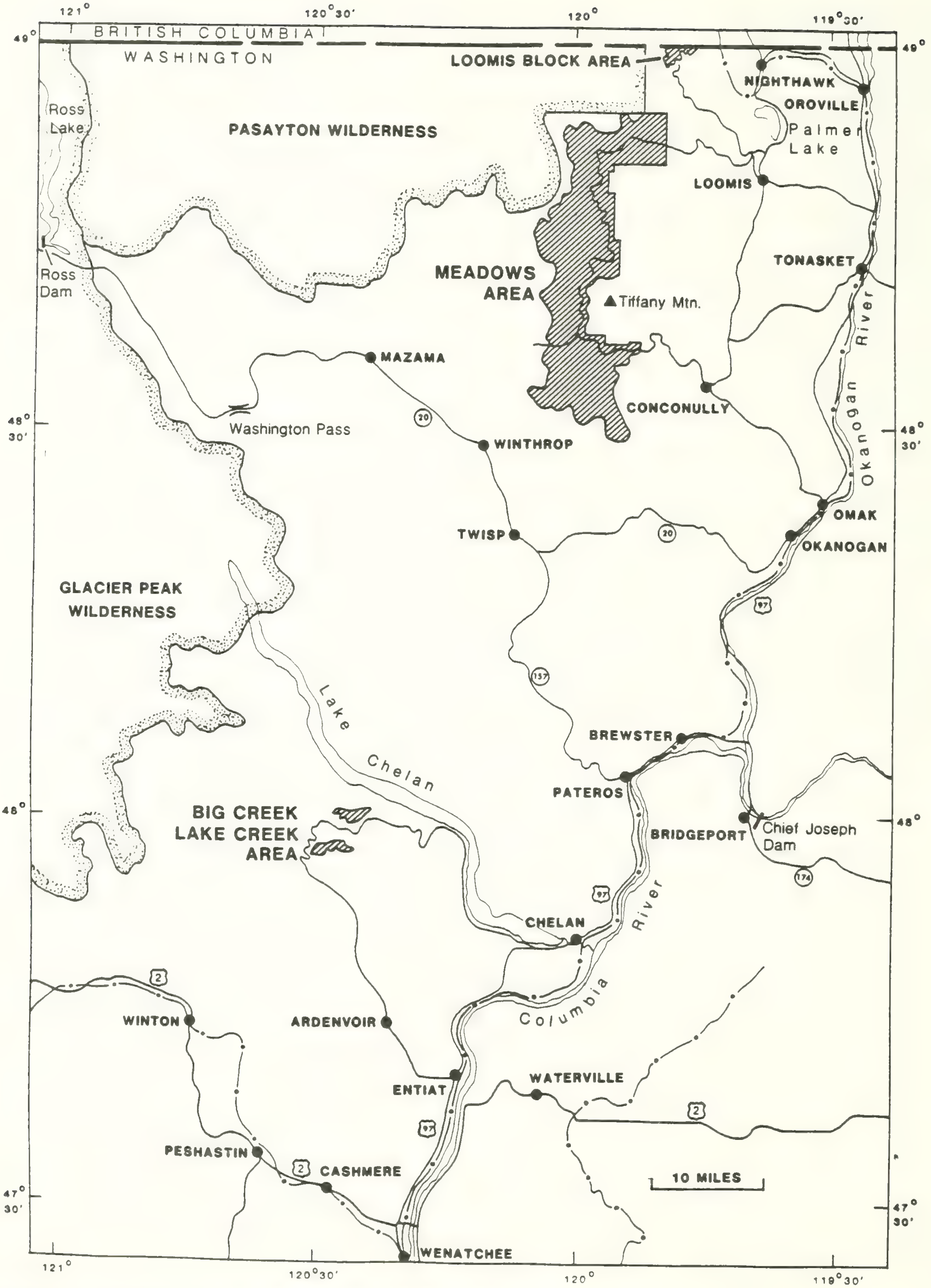

Figure 7-8—Vicinity map for the Meadows area of the Okanogan National Forest, the Loomis Block area of the State Forest, and the Big Creek-Lake Creek area of the Wenatchee National Forest—all in Washington.

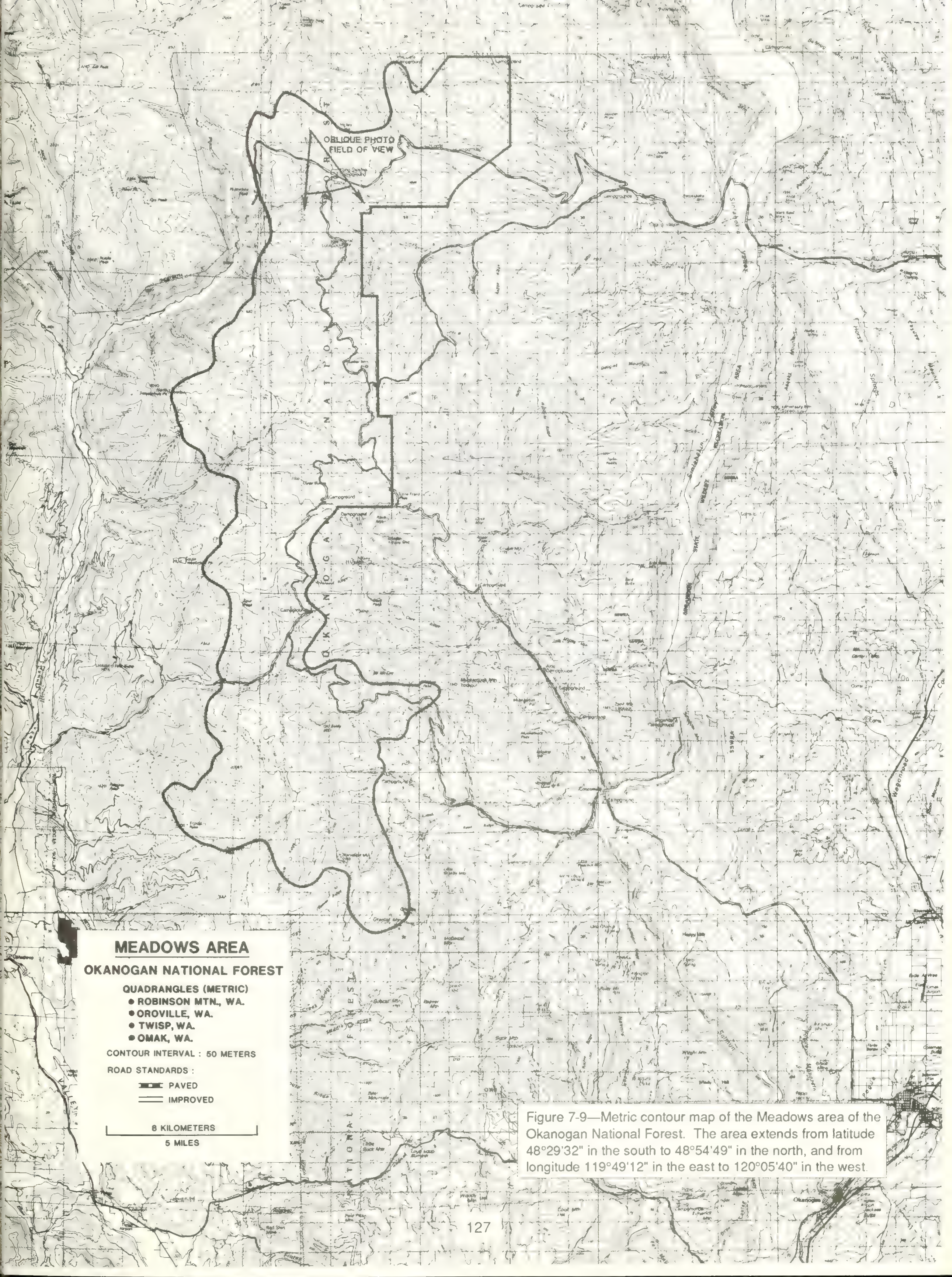

Figure 7-9—Metric contour map of the Meadows area of the Okanogan National Forest. The area extends from latitude 48°29'32" in the south to 48°54'49" in the north, and from longitude 119°49'12" in the east to 120°05'40" in the west.

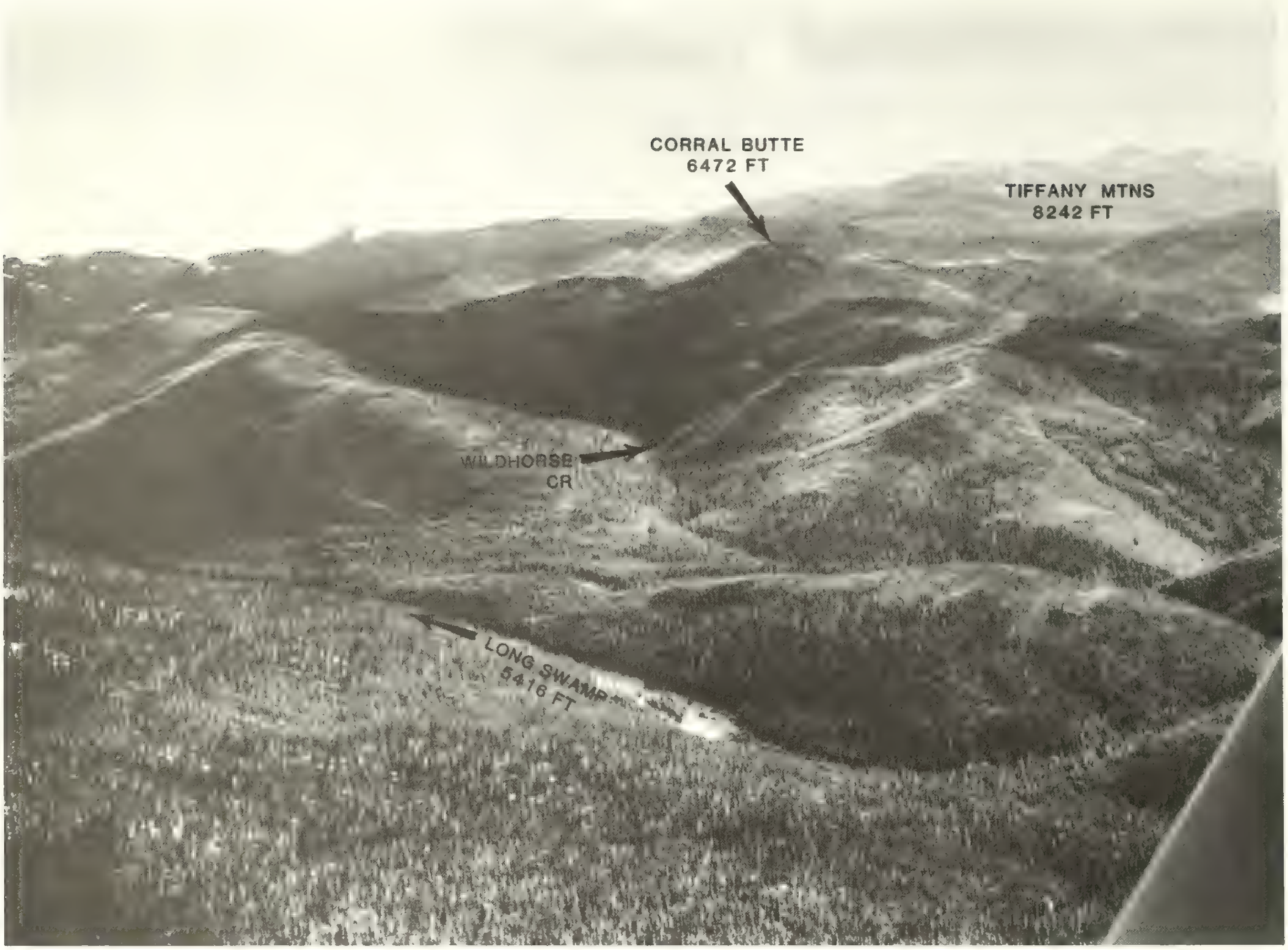

Figure 7-10—Oblique view of the Meadows area of the Okanogan National Forest looking south from near the north border of the area. See figure 7-9 for camera viewpoint and field. Width of foreground shown is about $1\frac{1}{2}$ miles; from the foreground to low background (Corral Butte) is about 3 miles. The Tiffany Mountains on the skyline are about 13 miles distant.

General Character of the Timber—Acreage by forest type on the area is as follows:

Lodgepole pine		
Mature/small sawtimber (including much pole material)	26,870	
Pole timber	11,800	
Seedlings and saplings	8,500	
Total lodgepole type		47,170
Mixed conifer and other (including significant lodgepole volume)		24,920
Noncommercial and nonforest		16,910
Total acres		89,000

As is usually the case, the lodgepole timber varies in a continuum from one stand to another (figs. 7-11 and 7-12), with diameters mostly less than 9 inches. In the north portion of the area stands are mostly of sapling and pole size, whereas in the south there are significant acreages of small sawlogs carrying about 8,000 bd ft per acre Scribner scale.

Some portions were burned 90 to 100 years ago, and on those acreages not burned in this fire the trees are about 200 years old.

Mortality from mountain pine beetles is not currently evident, but managers predict significant beetle attacks within 5 to 10 years. Rust-caused cankers are not evident, and there is little damage from porcupines. A significant number of live trees have forked stems, and stems of down timber display more-than-usual spiral grain, however (fig. 7-13).

Data on Sample Trees—To provide more than casual observational data descriptive of the trees, a pair of adjacent codominant lodgepole pines $3\frac{1}{2}$ to 4 inches in d.b.h. were destructively sampled from gently sloping terrain at 6,250 feet about $1\frac{1}{2}$ miles north of Corral Butte. Some pertinent tree characteristics follow. These tabulated data should not be interpreted as statistically representative of all trees.

See appendix for an explanation of tree selection and procedures for evaluation of mechanical properties in compression parallel to the grain at 10 percent moisture content.

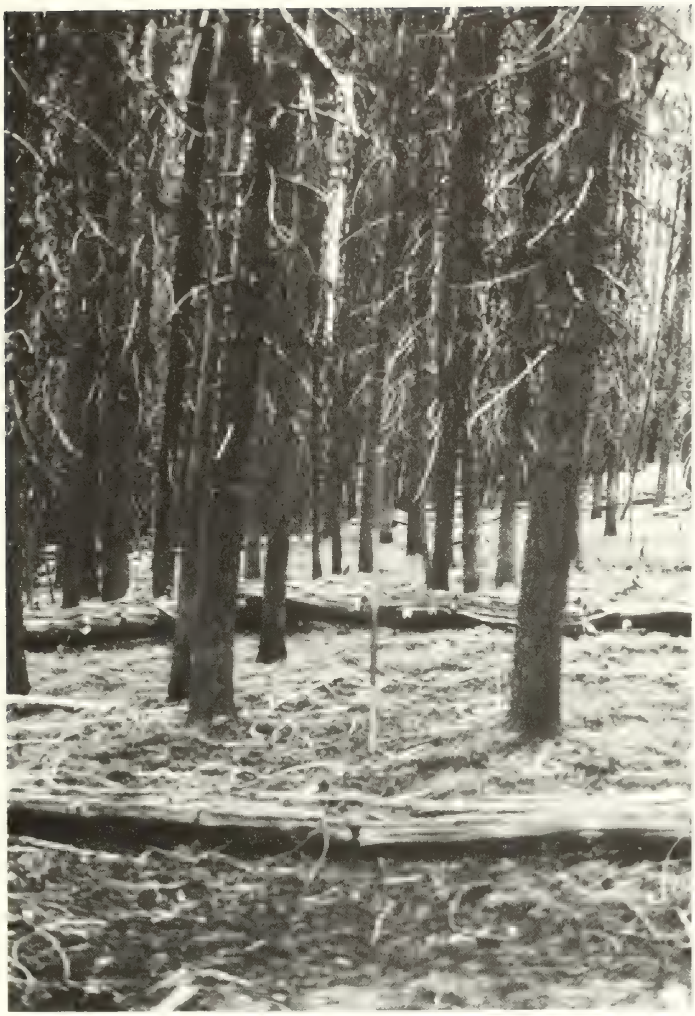

Figure 7-11—Lodgepole pine pole timber growing with little undergrowth at 6,500 feet just east of Corral Butte in the Meadows area of the Okanogan National Forest. The stadia rod in center foreground has 1-foot markings.

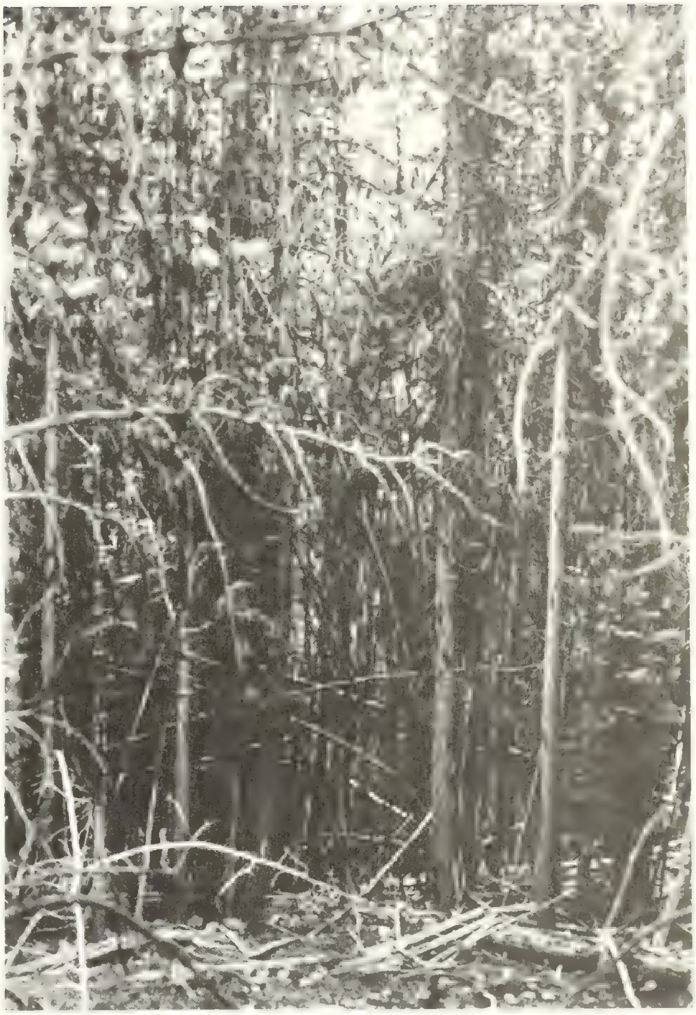

Figure 7-12—Stagnated stand of lodgepole (all less than 3 inches in d.b.h.) between Long Swamp and Corral Butte in the Meadows area of the Okanogan National Forest.

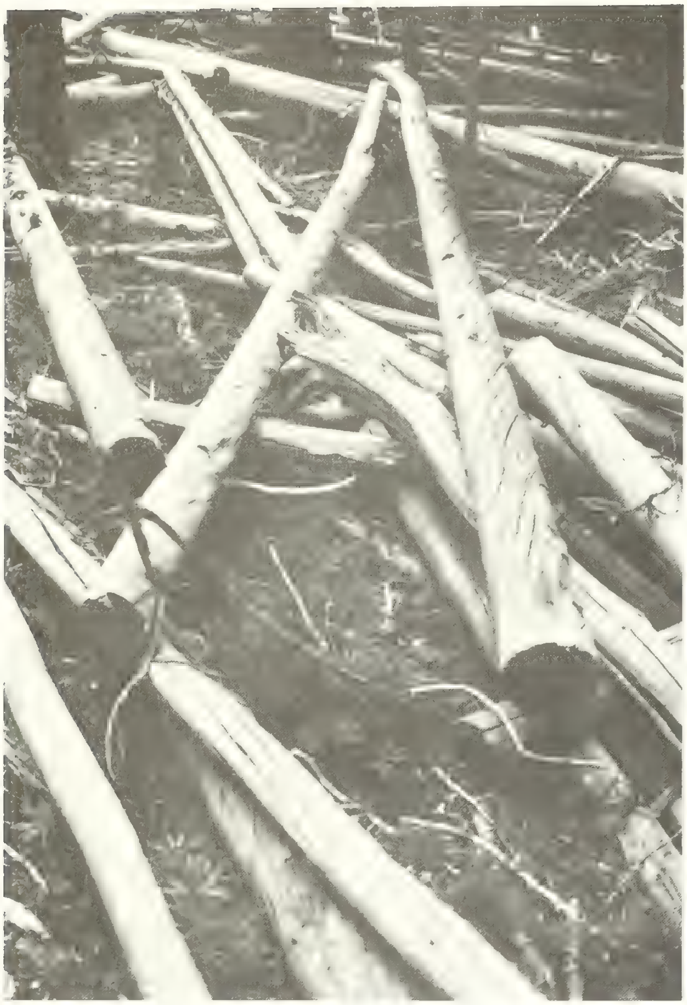

Figure 7-13—Spiral grain in air-dried pole-size lodgepole stems in the Meadows area of the Okanogan National Forest.

Characteristic	Tree number 1	Tree number 2
D.b.h. (outside bark), inches	3.57	3.82
Tree height above 6-inch high stump, feet	35.3	37.5
Crown ratio, percent	28.3	14.7
Cone serotiny	no observation made	
Tree age years (number of annual growth rings)		
Stump height	100	98
20 percent of tree height	75	64
Base of live crown	37	41
Diameter inside bark, inches		
Stump height	3.77	4.08
20 percent of tree height	3.10	3.36
Base of live crown	1.90	2.41
Height from stump top to base of crown, inches	304	384
Stem taper inside bark, inches/100 inches		
Below crown	0.62	0.43
Within crown	1.58	3.65
Rings/inch, average for section		
Stump height	53	48
Base of live crown	39	34
Properties of stemwood at 20 percent height		
Moisture content, percent ovendry weight	111.3	91.2
Specific gravity, ovendry weight and green volume	0.400	0.466
Rings/inch in first 1¼ inches radius	48	28
Maximum crushing strength, lb f/in²	6,200	7,030
Proportional limit, lb f/in²	3,510	5,270
Modulus of elasticity, lb f/in²	1,470,000	1,710,000
Compression wood evident?	none	none
Spiral grain angle at surface, degrees	5	2
Bark thickness (single), inch	0.12	0.11
Pith eccentricity, inch	0.1	0.1

Inventory Data—Inventory data on the area are incomplete. As noted previously, the area contains mixed-conifer stands as well as pure lodgepole stands, and the southern portion has some small sawtimber, while the northern portion is mostly in pole stands.

To indicate the diameter distribution in northern-portion stands, summary data on three large areas adjacent to Corral Butte are tabulated below. Stands 1 and 5 are mixed conifer (lodgepole pine, subalpine fir, Engelmann spruce, and Douglas-fir) in which 481 and 586 stems per acre, respectively, are larger than 3 inches in d.b.h. In stand number 2 (almost pure lodgepole) there are 1,081 live stems, of which 643 are larger than 3 inches in d.b.h.

Stand number and type	Total	<3 inches d.b.h.	>7 inches d.b.h.
	- - Number of live trees per acre - -		
1 (620 acres) mixed conifer	1,656	1,175	98
2 (1,108 acres) pure lodgepole	1,081	438	67
5 (1,150 acres) mixed conifer	1,253	667	131

Cubic Yield Potential and Height Growth—Data are not well documented, but managers of the area estimate that current growth is 27 to 58 ft³ of stemwood per acre per year, with most stands in the lower range. In managed stands, growth should be in the range from 35 to 65 ft³ per acre per year. Fifty-year height growth in managed stands is estimated to be 40 feet, possibly less.

Management Objectives for the Area and Constraints—The area is habitat for the lynx (*Lynx canadensis*), and management activities must be designed to protect the lodgepole pines that form the habitat. With this consideration in mind, it is the objective of the managers to accomplish phased harvests of the stagnated stands and to replace them with vigorous, young, controlled-density stands of lodgepole pine. If such harvests are timed appropriately, they can enhance wildlife habitat and watershed values and preserve recreational values.

The primary obstacle to management activities is the inability to market small stems from these stagnated stands—even at stumpage prices below $10 per M bd ft Scribner scale.

Other Lodgepole Pine Available in the Area From Public Lands—In addition to the 48,000 acres of lodgepole pine timber type in the Meadows area, the Okanogan National Forest administers about 20,000 acres of lodgepole east of Tonasket. Also, the State Forest of Washington has about 30,000 additional acres of similar lodgepole pine east and west of Tonasket.

Forest Products Industry in the Vicinity—Sawmills manufacturing random-length dimension lumber are located in Oroville, Tonasket vicinity, Republic, and Omak vicinity; the mill in Omak also has a plywood plant. Additionally, there is a large plant near Omak that manufactures pine lumber (mostly ponderosa pine) for furniture. South of Oroville on the Burlington Northern rail line there is a facility for transshipping (reloading) pulp chips en route to plants on the Columbia River west of the Cascades.

Population in the Vicinity—In 1980 the total population of Okanogan County was 30,639, and the town of Okanogan—the county seat—had a population of 2,302. Omak, with a population (1980) of 4,007, is the largest community in the county. Annual per-capita income in 1984 was $10,949 in Okanogan County. During October 1986, 10.4 percent of those in the workforce were unemployed.

WENATCHEE NATIONAL FOREST

Area Name and Location—The Big Creek-Lake Creek area (figs. 7-8, 7-14, and 7-15), which lies at an elevation of 4,000 to 6,200 feet at latitude 47°58' and longitude 120°27', is in the Chelan and Entiat Ranger Districts of the Wenatchee National Forest; the Ranger Stations are in Chelan and Entiat.

The gross delineated area totals about 2,000 acres, all of which are in lodgepole pine timber type except for a few stringers of spruce along stream edges, and falls entirely within Chelan County; Wenatchee is the county seat. The delineated area is in two adjacent, but separate acreages—one on the upper end of the Big Creek drainage, and the other to the south of Lake Creek (figs. 7-14 and 7-15). Junior Point at the east end of the Big Creek acreage is 2½ air miles south of Lake Chelan. The access road (where it passes between the two acreages) is about 24 air miles northwest of Entiat on a heading of 332°, and 22 air miles west-northwest of the town of Chelan on a heading of 295°.

Maps of the Area—USGS quadrangle 7½' maps needed to depict the area are the following: Silver Falls and Brief.

Access—A paved road runs from Entiat on the Columbia River (elevation 800 feet) for 29 miles up the Entiat River to a junction (at 2,418 feet elevation) with graveled Shady Pass Road running north for 4 miles to a motorbike trail (at 3,900 feet), which leads up the west side of Lake Creek and provides the easiest access into the Lake Creek drainage (fig. 7-16).

Shady Pass Road continues north and east between the two delineated acreages for another 11 miles to its highest point (6,654 feet) adjacent to Junior Point at the eastern extremity of the Big Creek delineated area. From this high point the road drops to Chelan Lake to the north and then follows the lake's southern shoreline to the town of Chelan, 40 miles distant from Junior Point. The elevation of Chelan is 1,000 feet.

Both Entiat and Chelan are on the Burlington Northern rail line connecting Oroville and Wenatchee. For highway distances from Chelan to various market centers in the United States, see table 1-2.

Terrain and Soil—As previously noted, the area lies between 4,000 and 6,200 feet elevation. Because the area has purposely been delineated to include steeper portions of the two drainages, half or more of the area has slopes exceeding 45 percent. Soil is comprised of a several-foot-deep deposition of volcanic ash and pumice. Steepness of terrain and distance from access roads appear to be the major obstacles to harvesting.

Annual Precipitation and Duration of Snow-free Season—Annual precipitation totals about 40 inches and falls mostly as snow. The snow-free season generally extends from June 1 through October.

General Character of the Timber—Within the 2,000 acres delineated, stands are virtually pure lodgepole, originating from a forest fire near the end of the last century. Most trees are less than 7 inches in d.b.h., and most are 35 to 40 feet tall, with crown ratios of 30 to 40 percent. Dead branch retention is not excessive, but trees appear to have more dead limbs at high elevation than at low.

While stands vary considerably, most are more or less stagnant, with typical acres having 1,000 to 3,000 live stems per acre, of which about 60 percent are 3 inches or larger in d.b.h. Except in occasional small "blow downs," there is not much dead timber on the ground and undergrowth is relatively light. Some lodgepole pines in the area carry serotinous cones, and others carry open cones.

Mountain pine beetles attacked the area in the 1950's, but today mortality from these attacks is not evident. Dwarf mistletoe infestations and stem cankers appear to be minor, and no significant damage from porcupines is evident. Recent widespread forest fires have burned large acreages in all directions from the Big Creek and Lake Creek drainages, but none have entered the upper portions of these drainages for about 100 years.

There has been no harvest activity in the delineated area, but a main haul road is planned to enter the lower elevations of Lake Creek (fig. 7-14).

Data on Sample Trees—A pair of codominant lodgepole pines 3½ to 4 inches in d.b.h. were destructively sampled at an elevation of 4,500 feet from gently sloping terrain just west of Lake Creek and close to the western extremity of the delineated area (fig. 7-17). Some pertinent tree characteristics follow. These tabulated data should not be interpreted as statistically representative of all trees.

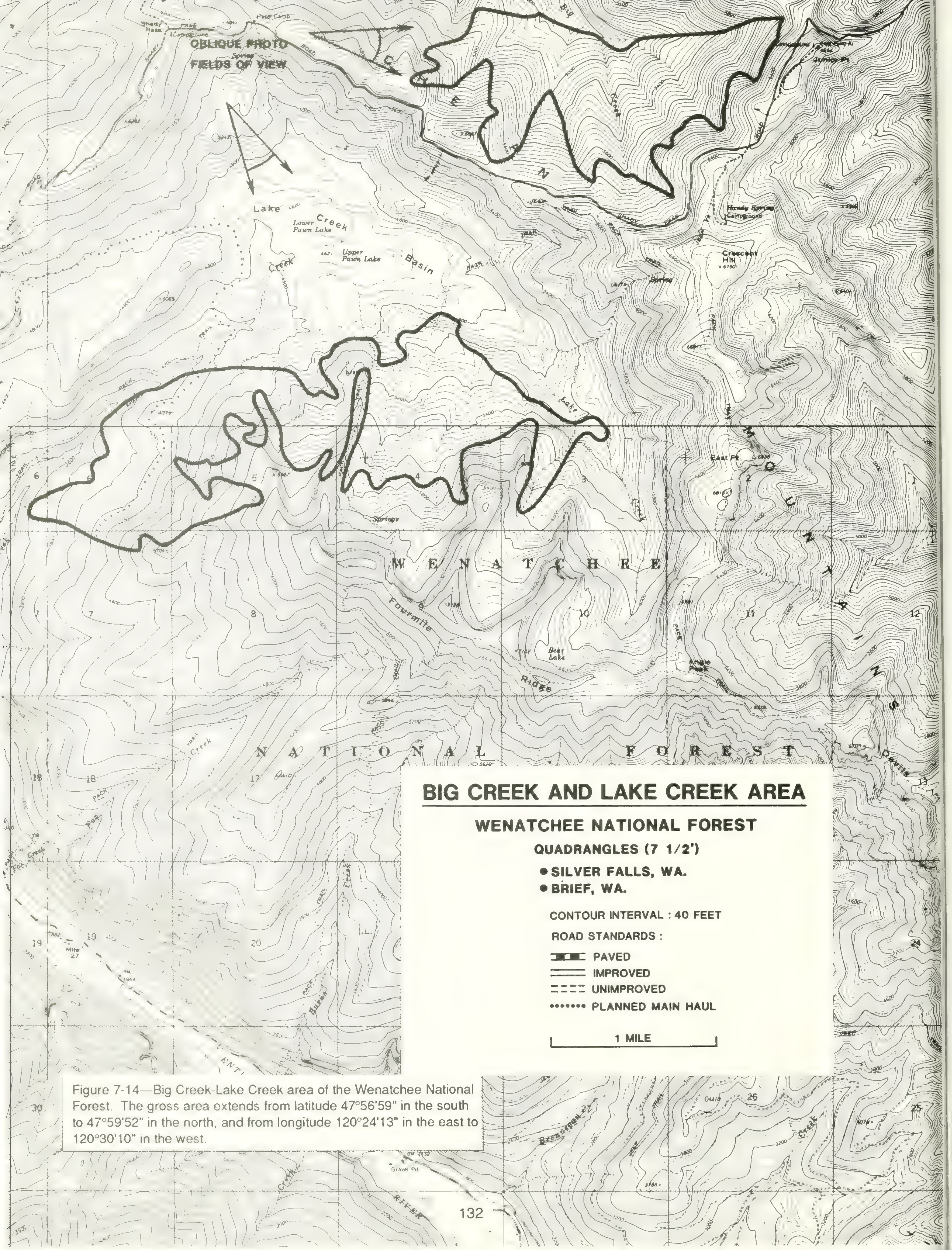

Figure 7-14—Big Creek-Lake Creek area of the Wenatchee National Forest. The gross area extends from latitude 47°56'59" in the south to 47°59'52" in the north, and from longitude 120°24'13" in the east to 120°30'10" in the west.

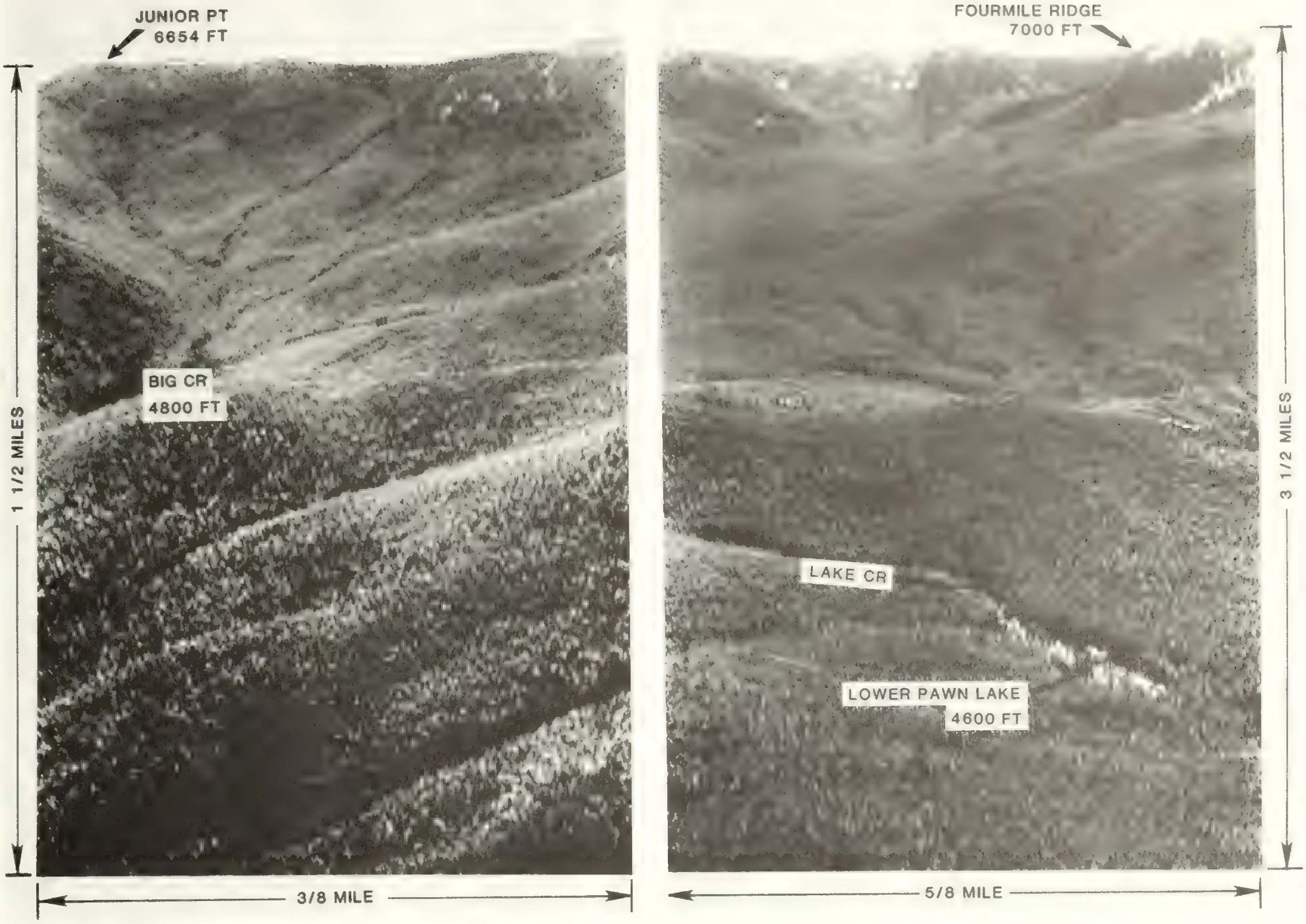

Figure 7-15—Oblique views of Big Creek-Lake Creek area of the Wenatchee National Forest. (Left) Looking east up Big Creek toward Junior Point. Width of foreground shown is about three-eighths mile; from the foreground to the ridgetop road on the skyline is about 1½ miles. (Right) Looking southeast across Lake Creek toward Fourmile Ridge. Width of foreground shown is about five-eighths mile; from the foreground to the ridge on the skyline is about 3½ miles. See figure 7-14 for camera viewpoints and fields.

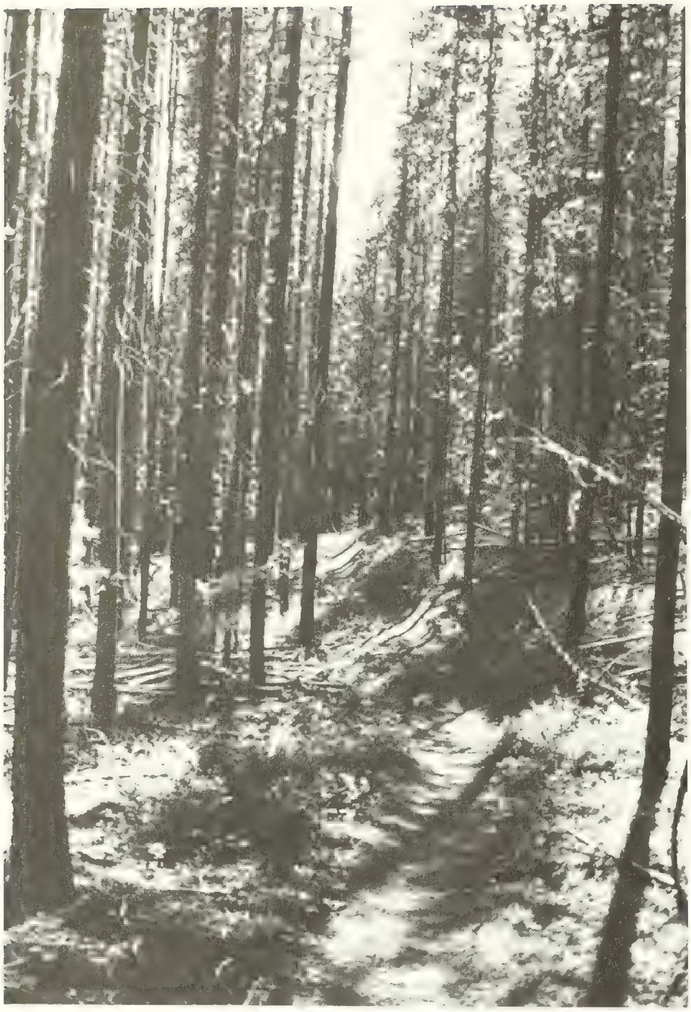

Figure 7-16—Looking northeast (at 4,500 feet elevation near west extremity of Lake Creek delineated area) along motorbike trail that runs up the west side of Lake Creek.

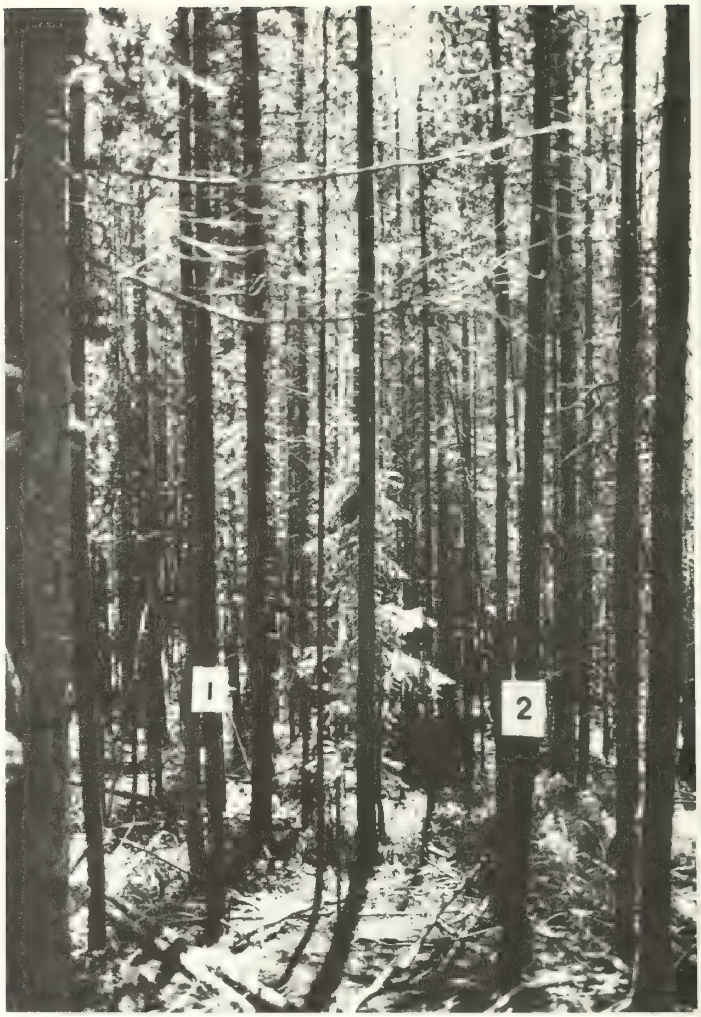

Figure 7-17—Pair of codominant lodgepole pines 3½ to 4 inches in d.b.h. sampled at an elevation of 4,500 feet just west of Lake Creek and close to the western extremity of the delineated area.

See appendix for an explanation of tree selection and procedures for evaluation of mechanical properties in compression parallel to the grain at 10 percent moisture content.

Characteristic	Tree number 1	Tree number 2
D.b.h. (outside bark), inches	3.72	3.97
Tree height above 6-inch high stump, feet	36.0	38.0
Crown ratio, percent	36.1	26.3
Cone serotiny	- no data taken -	
Tree age years (number of annual growth rings)		
Stump height	88	84
20 percent of tree height	63	79
Base of live crown	30	25
Diameter inside bark, inches		
Stump height	4.03	4.28
20 percent of tree height	3.33	3.43
Base of live crown	2.28	1.93
Height from stump top to base of crown, inches	276	336
Stem taper inside bark, inches/100 inches		
Below crown	0.63	0.74
Within crown	1.46	1.50
Rings/inch, average for section		
Stump height	44	39
Base of live crown	26	28
Properties of stemwood at 20 percent height		
Moisture content, percent ovendry weight	117.0	78.5
Specific gravity, ovendry weight and green volume	0.380	0.402
Rings/inch in first 1¼ inches radius	34	20
Maximum crushing strength, lb f/in^2	6,050	5,480
Proportional limit, lb f/in^2	4,500	3,740
Modulus of elasticity, lb f/in^2	1,270,000	1,140,000
Compression wood evident?	none	slight
Spiral grain angle at surface, degrees	2	5
Bark thickness (single), inch	0.14	0.11
Pith eccentricity, inch	0.2	0.4

Inventory Data—Inventory data for the area are incomplete. For comments on typical diameter distribution and tree height, see text under paragraph heading "General Character of the Timber."

Cubic Yield Potential and Height Growth—Although data are not well documented, managers responsible for the area estimate that current stands are growing at the rate of 30 to 40 ft^3 of stemwood per acre per year; the potential for managed stands is estimated at 100 ft^3 per acre per year. Fifty-year height growth in managed stands is estimated to be about 60 feet.

Management Objectives for the Area and Constraints—The primary objective is phased harvest of the stagnated stands and natural regeneration with vigorous, new, controlled-density lodgepole stands. Such harvests would be timed to enhance wildlife habitat and to protect watershed and recreational values.

The principal obstacle to achievement of management objectives is lack of markets for subsawlog-size stumpage growing on steep slopes with poor access. In the Entiat River drainage, small volumes of more accessible large-pole/small-sawlog lodgepole pine stumpage on tractor ground have been sold for $20 per M bd ft Scribner scale, with the purchaser bearing the cost of temporary road construction and cleanup following harvest.

Other Lodgepole Pine Available in the Area From Public Lands—Approximately 40,000 acres on the Entiat and Chelan Ranger Districts are now growing lodgepole pine, or will be growing it on the extensive areas burned by forest fires since 1970.

Forest Products Industry in the Vicinity—In Entiat, a doweling plant utilizes lodgepole pine with minimum top diameter of 7 inches to produce parts for playground structures. A sawmill cutting ponderosa pine and Douglas-fir is located in Peshastin, and a mill cutting 2- by 4-inch studs operates in Cashmere. In Wenatchee there is a market for large chips used in smelting operations.

Population in the Vicinity—In 1985 the total population of Chelan County was 48,500. Wenatchee, the county seat, has a population of 17,360, Chelan 3,000, and Entiat 492 (1985 data).

In 1981, annual per-capita income in Chelan County was $10,826, and 12.8 percent of those in the workforce were unemployed.

STATE FOREST

Area Name and Location—The delineated Loomis Block area (figs. 7-8, 7-18, and 7-19), which lies at an elevation of 4,400 to 6,193 feet at latitude 48°59' and longitude 119°47', is in the Northwest Management Area of the Washington State Forest; the area is headquartered in Colville.

The gross area of 2,120 acres includes about 1,700 acres of lodgepole pine timber type and falls entirely within Okanogan County. The town of Okanogan is the county seat. It is immediately south of the Canadian border, which forms the area's northern edge (fig. 7-18). The center of the delineated area is 14 air miles northwest of Loomis on a heading of 328°. Long Swamp Campground, on the northern edge of the 89,000-acre Meadows area of the Okanogan National Forest, lies only 11 air miles to the southwest on a heading of 205°.

Maps of the Area—USGS quadrangle 15' maps needed to depict the area are: Horseshoe Basin and Loomis.

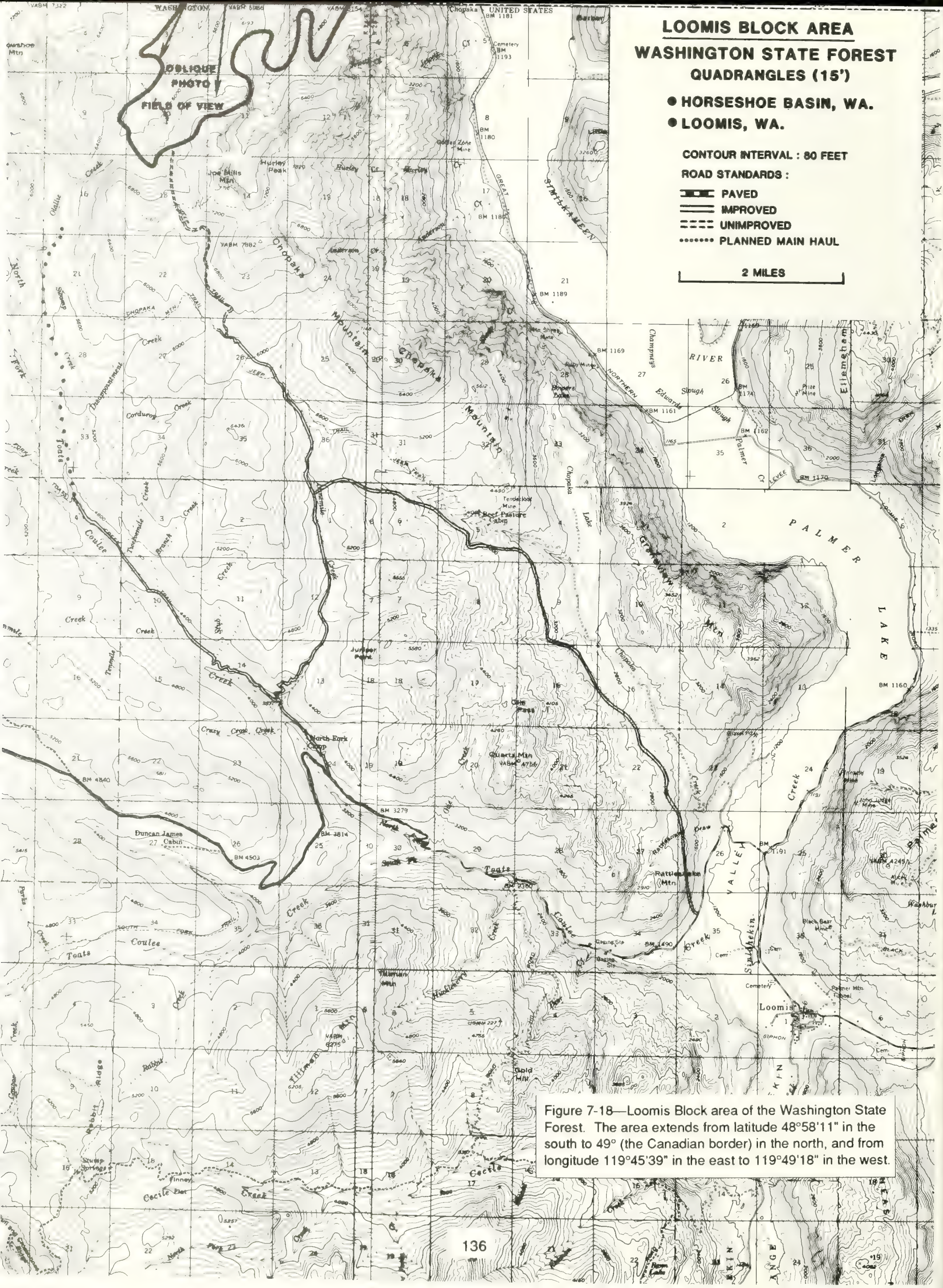

Figure 7-18—Loomis Block area of the Washington State Forest. The area extends from latitude 48°58'11" in the south to 49° (the Canadian border) in the north, and from longitude 119°45'39" in the east to 119°49'18" in the west.

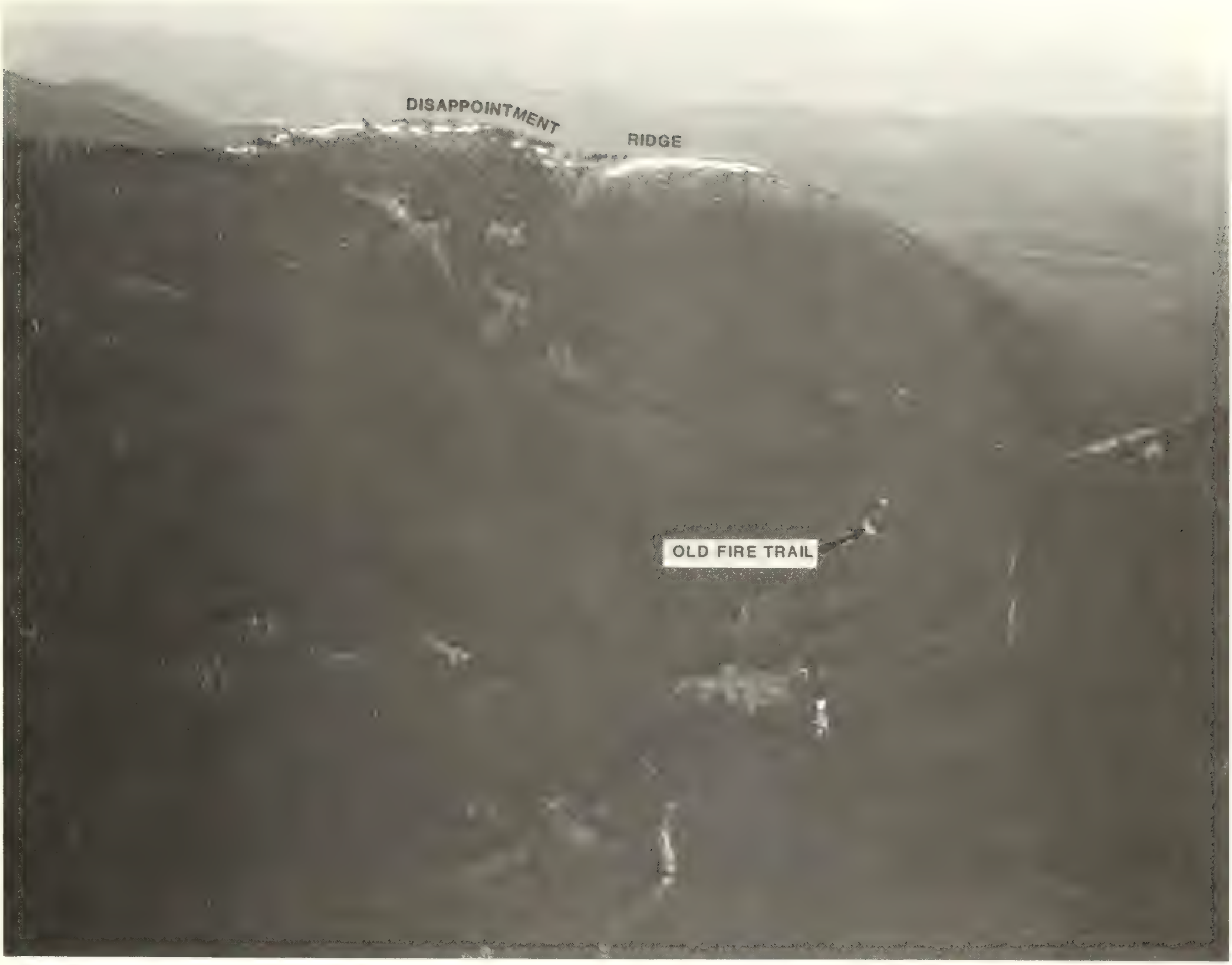

Figure 7-19—Oblique view of the Loomis Block area of the Washington State Forest looking south from near the Canadian border. See figure 7-18 for camera viewpoint and field. Joe Mills Mountain is just out of view to the left (east) of Disappointment Ridge. The old fire trail in center foreground connects to the unimproved dirt access road shown in figures 7-18 and 7-20.

Access—From Loomis (1,300 feet elevation) a paved road runs 9.8 miles northwest (to near North Fork Camp) from whence an all-weather gravel road extends 6.6 miles north and terminates at 6,250 feet elevation at the Cold Springs Picnic Area. Beyond this, a primitive jeep trail (portions washed out) runs another 6 miles north-northwest over a 7,000-foot ridge to descend to the southern border of the area (fig. 7-20).

A new main haul road is planned that will approach the southwest corner of the area via lower elevations along Toats Creek and Olallie Creek (figs. 7-18 and 7-21).

Tonasket and Omak, on the Burlington Northern line from Oroville to Wenatchee, are nearby railheads. Tonasket is about 18 highway miles southwest of Loomis and 24 miles north of Omak. For highway distances from Omak to various market centers in the United States, see table 1-2.

Terrain and Soil—As previously noted, the area lies between 4,400 and 6,193 feet elevation, mostly with northwest and north aspect, and with nearly two-thirds of the acreage having slopes of less than 45 percent. Soils are stony, coarse and fine sandy loams (fig. 7-20).

Annual Precipitation and Duration of Snow-free Season—Annual precipitation totals 20 to 35 inches. In winter, snow commonly accumulates to depths of 3 to 10 feet. The snow-free season generally extends from June 1 through October.

General Character of the Timber—The lodgepole pine trees in the delineated area are typically about 70 years old, 30 to 40 feet high, and 1 to 6 inches in d.b.h.—with an average of about 3 inches. Stems tend to retain dead limbs (fig. 7-22). Undergrowth is light, and down timber not prominent. Most of the stands date from forest fires near the turn of the century.

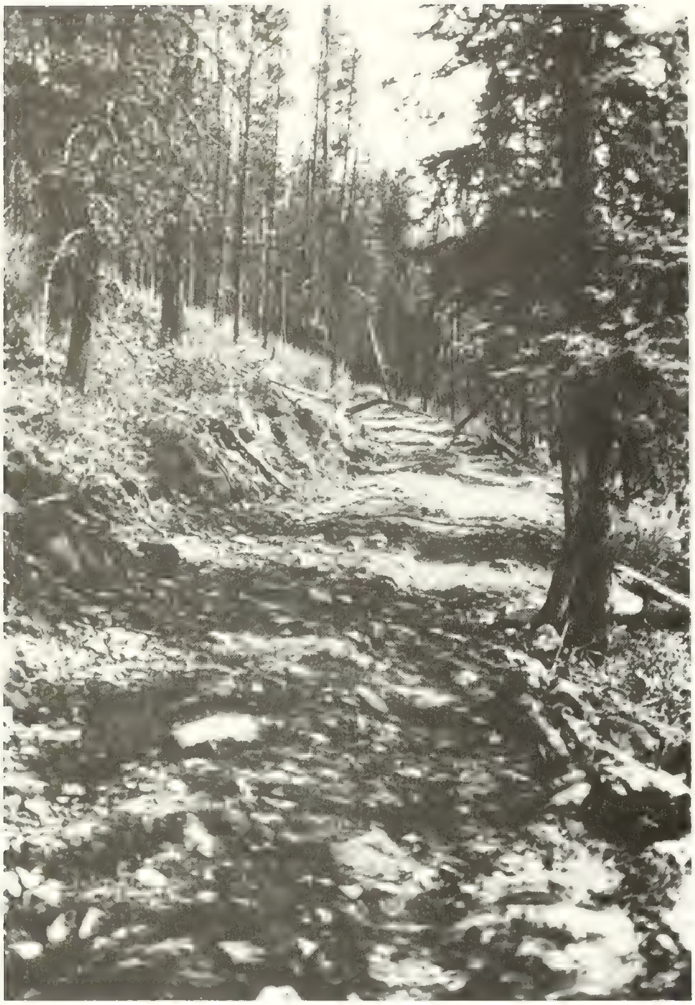

Figure 7-20—Looking south along the jeep-trail access road 1¼ miles south of the southern border of the Loomis Block area of the Washington State Forest; elevation is 6,800 feet.

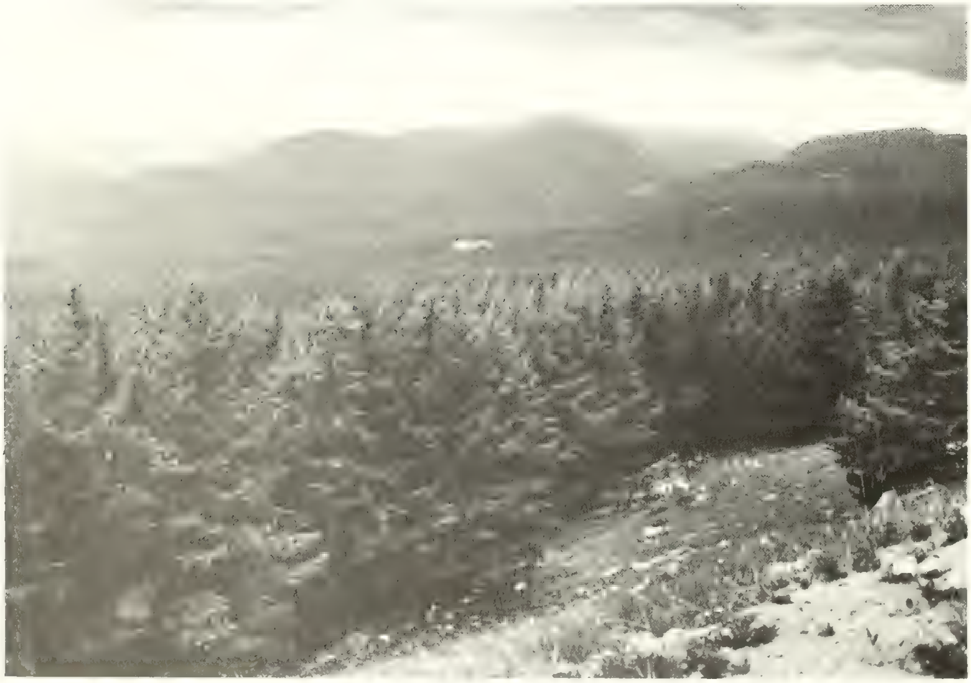

Figure 7-21—Looking southwest across the North Fork of Toats Creek and the vicinity of the planned major haul road (fig. 7-18) extending toward the delineated Loomis Block area of the Washington State Forest.

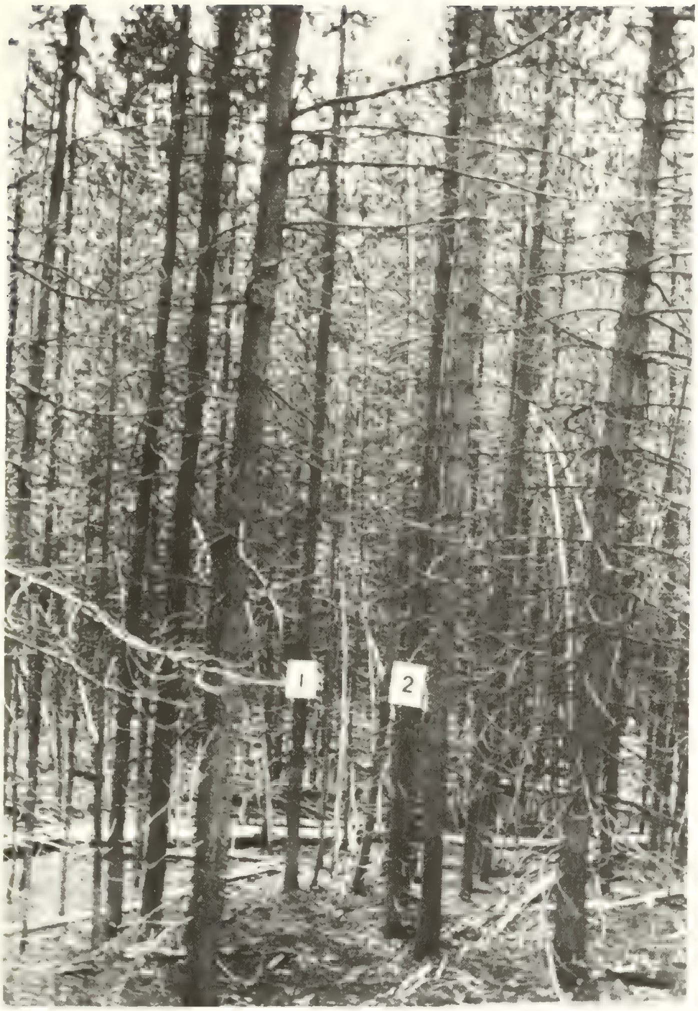

Figure 7-22—Pair of codominant lodgepole pines 3½ to 4 inches in d.b.h. sampled at 6,400 feet elevation along the jeep-trail access road about 2 miles south of the southern border of the delineated Loomis Block area of the Washington State Forest.

Mortality from mountain pine beetles is not evident, nor is damage from porcupines. At upper elevations just below tree line, massed cankers (burls) are present on lower stem sections of a significant number of the lodgepole pines along the jeep-trail access road south of the area.

Because of inaccessibility and low value of the trees, no harvests have been made in the delineated area, and none are planned for the immediate future. Where access is easier in the State forest in the vicinity, however, approximately 1,200 acres of lodgepole pine forest type will be harvested annually over the next 5 years (1987-92).

Data on Sample Trees—A pair of codominant lodgepole pines 3½ to 4 inches in d.b.h. were destructively sampled from gently sloping terrain at 6,400 feet elevation along the jeep-trail access road about 2 miles south of the delineated area (fig. 7-22). Some pertinent tree characteristics follow. These tabulated data should not be interpreted as statistically representative of all trees.

See appendix for an explanation of tree selection and procedures for evaluation of mechanical properties in compression parallel to the grain at 10 percent moisture content.

Characteristic	Tree number 1	Tree number 2
D.b.h. (outside bark), inches	3.67	3.31
Tree height above 6-inch high stump, feet	31.0	32.0
Crown ratio, percent	48.9	45.8
Cone serotiny	- no data taken -	
Tree age years (number of annual growth rings)		
Stump height	49	47
20 percent of tree height	37	37
Base of live crown	24	23
Diameter inside bark, inches		
Stump height	3.81	3.52
20 percent of tree height	3.17	2.93
Base of live crown	2.55	2.29
Height from stump top to base of crown, inches	190	208
Stem taper inside bark, inches/100 inches		
Below crown	0.66	0.59
Within crown	1.40	1.30
Rings/inch, average for section		
Stump height	26	27
Base of live crown	19	20
Properties of stemwood at 20 percent height		
Moisture content, percent ovendry weight	129.1	92.5
Specific gravity, ovendry weight and green volume	0.380	0.400
Rings/inch in first 1¼ inches radius	19	25
Maximum crushing strength, lb f/in²	5,130	5,220
Proportional limit, lb f/in²	3,620	3,890
Modulus of elasticity, lb f/in²	950,000	1,080,000
Compression wood evident?	none	none
Spiral grain angle at surface, degrees	3	0
Bark thickness (single), inch	0.15	0.10
Pith eccentricity, inch	0.1	0.1

Inventory Data—Inventory data on the delineated area are lacking. Data gleaned from timber type maps made in the 1960's are summarized under the paragraph heading "General Character of the Timber."

Cubic Yield Potential and Height Growth—Although data are not well documented, the managers estimate that the area currently has about 1,500 ft³ of stemwood per acre; the growth potential for managed stands is estimated to be double that of existing stands. Fifty-year height growth in managed stands is estimated to be 30 to 40 feet.

Management Objectives for the Area and Constraints—The primary management objective is phased harvest of the stagnated stands and replacement through natural regeneration with vigorous, new, controlled-density lodgepole pine stands. No thinning of the new stands is contemplated.

Appropriately timed, such harvests should enhance habitat for the substantial population of mule deer in the vicinity and also protect watershed and recreational values.

As noted previously, the principal obstacle to achieving these management objectives is lack of markets for small-diameter trees distant from haul roads.

Other Lodgepole Pine Available in the Area From Public Lands—Outside the delineated area, but within the general vicinity where access is easier, the State plans to harvest about 6,000 acres in the years 1987-92. Farther south and adjacent to the Okanogan National Forest, the State has an additional 30,000 acres of similar lodgepole pine forest type for which there is little market. The State prices lodgepole pine sawtimber stumpage on these acres at $14 to $25 per M bd ft Scribner scale.

As noted in discussion of the Meadows area of the Okanogan National Forest, an additional 48,000 acres of lodgepole pine timber type lies south of Long Swamp, only 11 air miles southwest from the State's delineated area (fig. 7-8).

Forest Products Industry in the Vicinity—A portable sawmill cutting 2- by 4-inch studs is in operation cutting lodgepole pine timber from State lands in the vicinity.

Fixed-location sawmills manufacturing random-length dimension lumber are located in Oroville, Tonasket vicinity, Republic, and Omak vicinity. The mill in Omak also has a plywood plant. Additionally, there is a large plant near Omak that manufactures pine lumber (mostly ponderosa pine) for furniture. South of Oroville on the Burlington Northern rail line there is a facility for transshipping (reloading) pulp chips en route to plants on the Columbia River west of the Cascade Mountains.

The Tonasket mill is a modern small-log operation with annual capacity of about 60 million bd ft of random-length dimension lumber.

Population in the Vicinity—In 1980 the total population of Okanogan County was 30,639, and the town of Okanogan—the county seat—had a population of 2,302. Omak, with a population of 4,007, is the largest community in the county. In 1984, annual per-capita income was $10,949 in Okanogan County, and during 1985, 16.0 percent of those in the workforce were unemployed.

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CHAPTER 8: WYOMING

INTRODUCTION

In Wyoming, lodgepole pine predominates on about 1.8 million acres of the State's 4.3 million acres of commercial forest land, with about 3.0 billion ft^3 of lodgepole pine growing stock and 10.7 billion bd ft of sawtimber (table 8-1). Approximately 40 percent of the softwood growing stock and 36 percent of the softwood sawtimber in the State is lodgepole pine (Green and Van Hooser 1983).

Approximately 45 percent of the dry weight of above-ground biomass in lodgepole pine trees in Wyoming is in trees smaller than the 10-inch d.b.h. class (table 8-2).

Managers of public forest lands in Wyoming selected for study four areas (fig. 8-1) totaling 143,880 acres in gross area. The study areas are individually described in the following text.

Table 8-1—Volume of lodgepole pine growing stock and sawtimber, and acreage in lodgepole pine, by ownership class, Wyoming[1]

Ownership class	Growing stock[2]	Sawtimber volume[3]	Commercial timberland area
	Million ft^3	*Million bd ft International 1/4-inch scale*	*Thousand acres*
National Forest (commercial)[4]	2,558	9,677	1,569
Other public	190	455	110
Forest industry	—	—	—
Other private	224	617	122
Total	2,972	10,749	[4]1,801

[1] Source: Green and Conner [In preparation]. Information presented is based on 1985 data.

[2] **Growing stock volume** = net volume in cubic feet of live sawtimber and pole timber trees (5 inches d.b.h. and larger) from stump to a minimum 4-inch top outside bark, or to the point where the central stem breaks into limbs.

[3] **Sawtimber volume** = net volume in board feet of the sawlog portion of live sawtimber trees. Sawtimber trees are live trees of commercial species, 9 inches in d.b.h. or larger (softwood), containing at least one 12-foot sawlog or two noncontiguous 8-foot sawlogs, and meeting regional specifications for freedom from defect.

[4] **Commercial timberland** = forest land that is capable of producing crops of industrial wood and not withdrawn from timber utilization by statute or administrative regulation. Areas qualifying as commercial timberland have the capability of producing in excess of 20 ft^3 per acre per year of industrial wood in natural stands.

Table 8-2—Dry weight of lodgepole pine trees, by tree component and diameter class—Wyoming[1]

Diameter class	Bole[2]	Top[2]	Total
Inches	*- - Thousand tons, ovendry basis - -*		
2	—	2,296	2,296
4	—	5,297	5,297
6	5,368	3,870	9,238
8	7,024	2,275	9,299
10	8,110	2,187	10,297
12	6,537	1,900	8,437
14	4,781	1,268	6,049
16	2,339	606	2,945
18	1,570	396	1,966
20+	1,353	358	1,711
Total	37,082	20,453	57,535

[1] Source: Van Hooser and Chojnacky (1983).

[2] **Trees 5+ inches d.b.h.**: Bole weight = ovendry weight of wood and bark from a 1-foot stump to a 4-inch top diameter, inside bark; top weight = ovendry weight of wood and bark from a 4-inch diameter to tip of tree, plus branch material down to 1/4-inch diameter.

Trees less than 5 inches d.b.h.: Total ovendry weight of wood and bark from a 1-foot stump to tip of tree, plus branch material down to 1/4-inch diameter (tabulated under "Top").

WYOMING

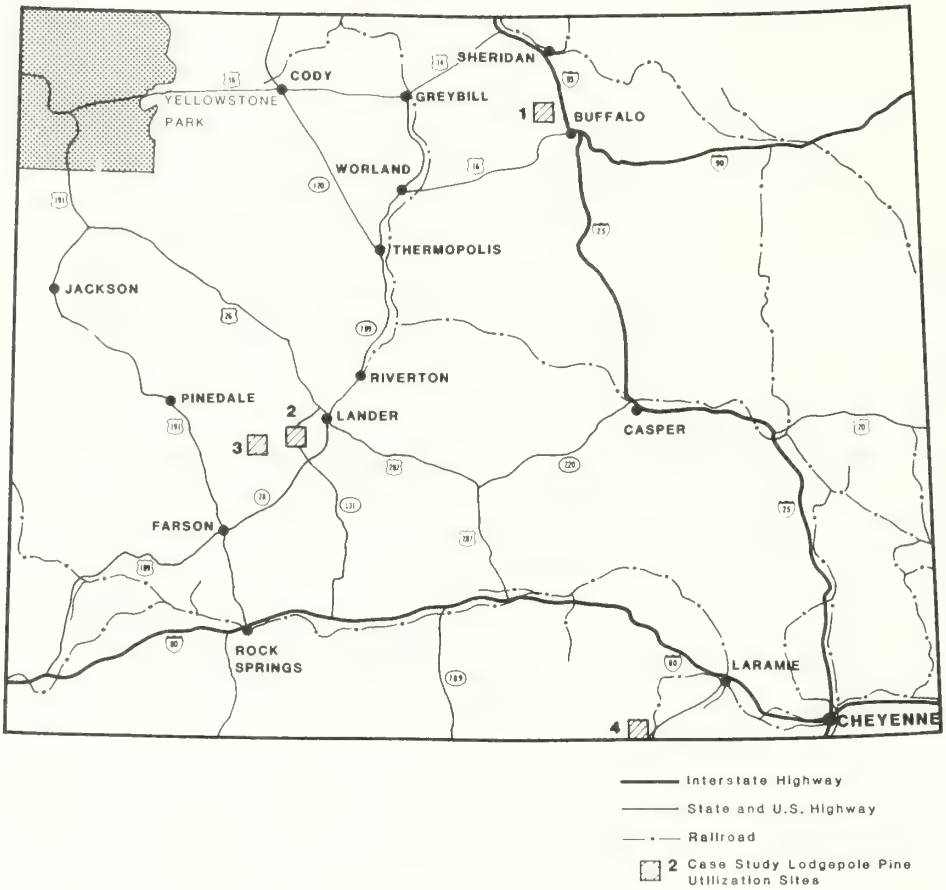

Figure 8-1—Wyoming location map. 1. Bighorn NF (Piney Creek-Rock Creek) 75,000 acres. 2. Shoshone NF (Grannier Meadow-Dickinson Park area) 35,000 acres. 3. Bridger-Teton NF (South Wind River area) 41,000 acres. 4. Medicine Bow NF (Upper Pelton Creek area) 7,880 acres.

BIGHORN NATIONAL FOREST

Area Name and Location—The Piney Creek-Rock Creek area (figs. 8-2, 8-3, and 8-4), which lies at an elevation of 6,500 to 9,800 feet at latitude 44°27' and longitude 107°, is in the Buffalo and Tongue Ranger Districts of the Bighorn National Forest; the Ranger Stations are in Buffalo and Sheridan, respectively.

The gross area of about 75,000 acres includes about 50,000 acres of lodgepole pine timber type and lies entirely within Johnson County; Buffalo is the county seat. The area is centered around Willow Park Reservoir just east of the Cloud Peak Wilderness area. The center of the north border of the area is 15 air miles due south of Sheridan. The center of the south border of the area is 13 air miles due west of Buffalo.

Maps of the Area—USGS quadrangle 7½' maps needed to depict the area are: Big Horn, Cloud Peak, Hunter Mesa, Lake Angeline, Little Goose Peak, Park Reservoir, Stone Mountain, Storey, and Willow Park.

Access—Access to the area is difficult. The principal route penetrating the area is via a gated dirt road, privately built to maintain an irrigation system originating at the Willow Park Reservoir, and negotiable by four-wheel-drive vehicles. The lower terminus (at about 4,800 feet elevation) of this dirt road is 19 miles south of Sheridan just south of Storey at Little Piney Creek (fig. 8-3). From this lower terminus the road climbs steeply for 4 or 5 miles (with sharp switchbacks) through private land before reaching the National Forest boundary at 7,500 feet—the lower edge of the lodgepole pine forest type. From the lower terminus of the dirt road it is 12 miles to Willow Park Reservoir, which lies at an elevation of 8,600 feet.

The only other access road is the Red Grade road west of Sheridan; this dirt road ascends an 18-percent grade to the plateau at the north border of the area. In spite of its steepness, logs are now hauled down this road—usually at night to avoid recreational traffic—to the Sheridan area, a distance of about 40 miles from the area's north border.

To avoid this grade, a main haul road is planned that would enter the area from the northwest and traverse Penrose Park to reach Willow Park Reservoir. Log trucks using this route could descend U.S. Highway No. 14 to the railhead town of Ranchester—a haul distance of about 65

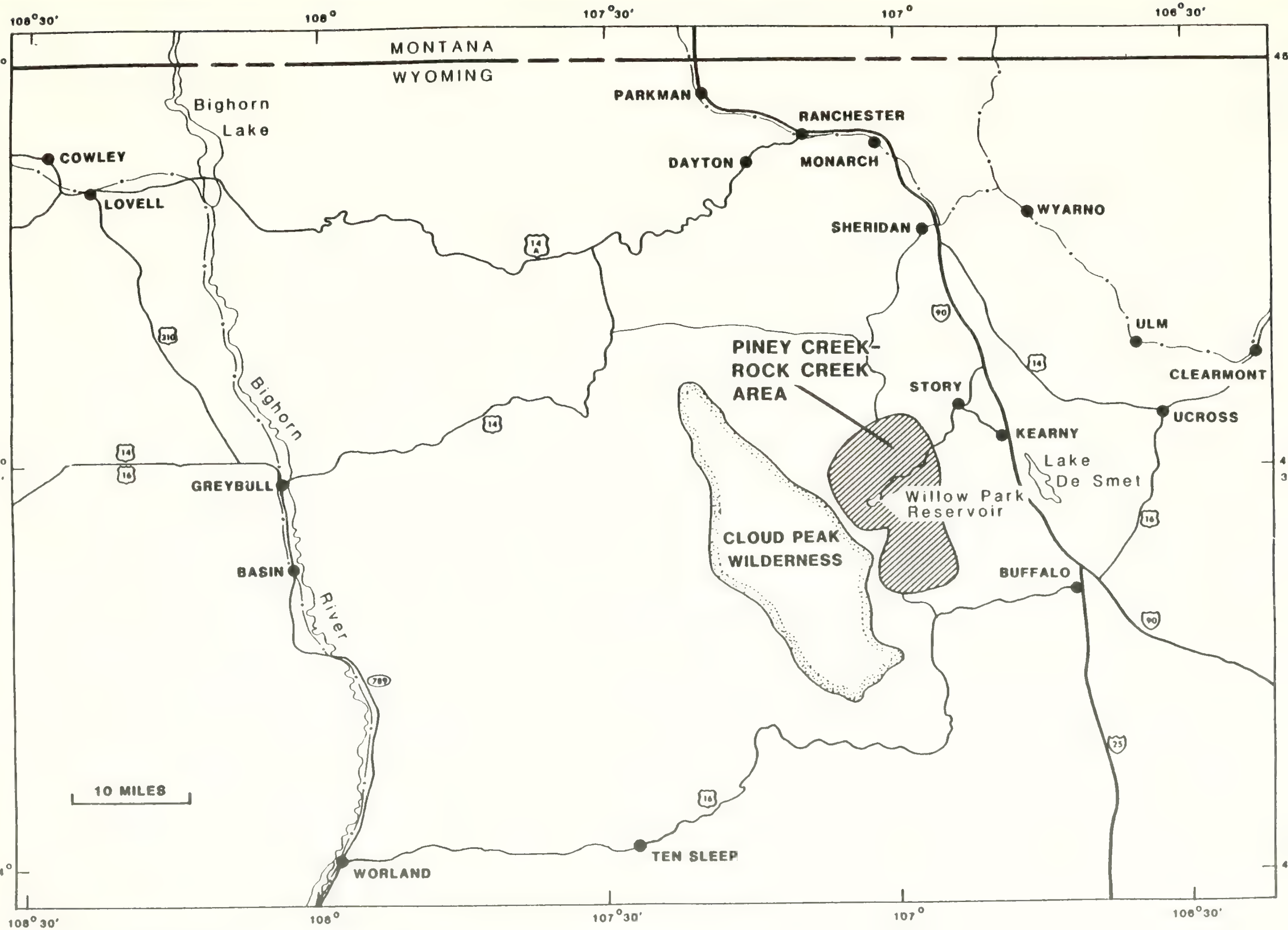

Figure 8-2—Vicinity map for the Piney Creek-Rock Creek area of the Bighorn National Forest in Wyoming.

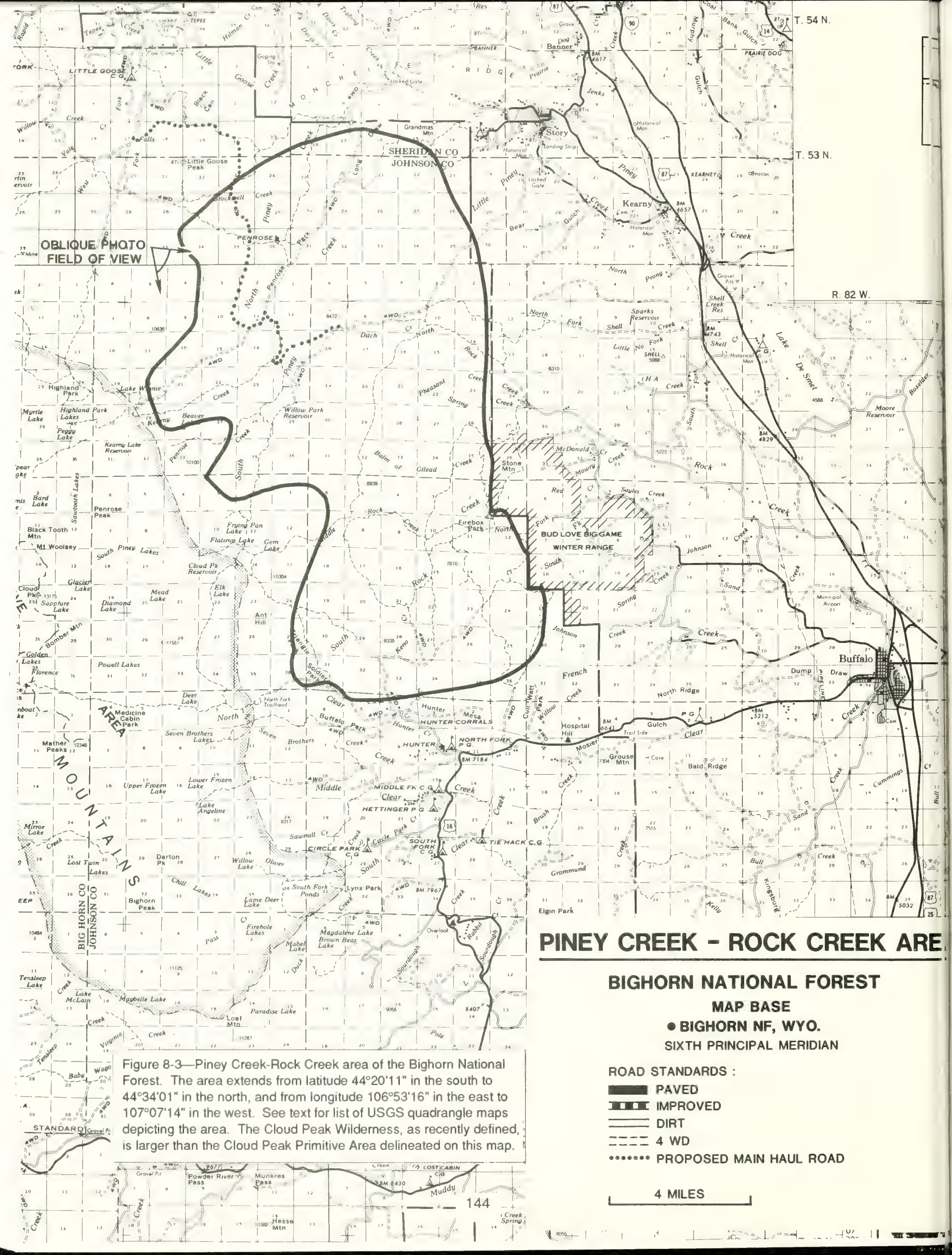

Figure 8-3—Piney Creek-Rock Creek area of the Bighorn National Forest. The area extends from latitude 44°20'11" in the south to 44°34'01" in the north, and from longitude 106°53'16" in the east to 107°07'14" in the west. See text for list of USGS quadrangle maps depicting the area. The Cloud Peak Wilderness, as recently defined, is larger than the Cloud Peak Primitive Area delineated on this map.

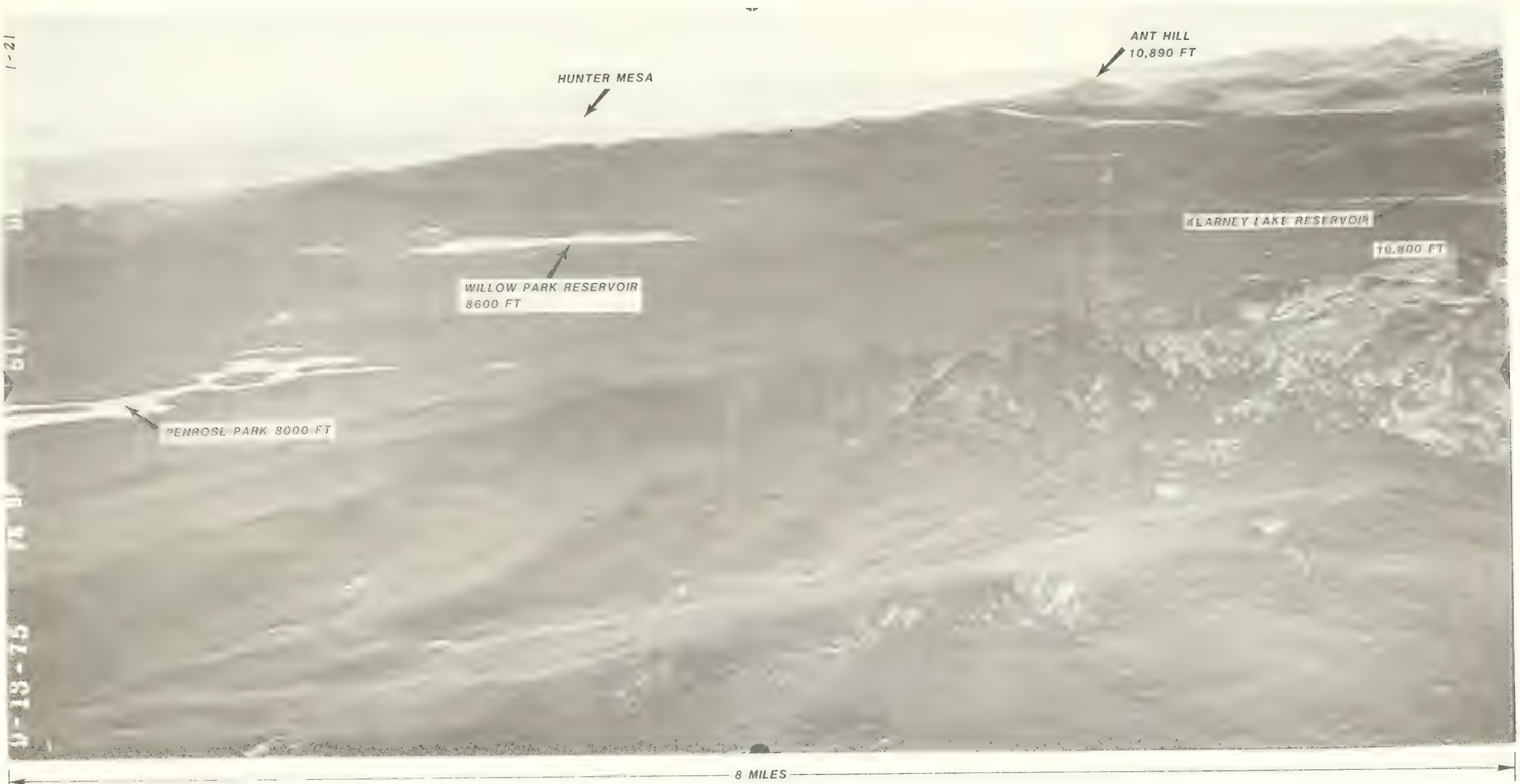

Figure 8-4—Oblique view of Piney Creek-Rock Creek area of the Bighorn National Forest looking southeast across Penrose Park and Willow Park Reservoir toward Ant Hill Peak; see figure 8-3 for approximate camera viewpoint and field. Width of foreground shown is about 8 miles. From the line of peaks traversing the center foreground of the photo to the dark timbered ridge in the background is 8 to 10 miles. The immediate foreground is in the Cloud Peak Wilderness area.

miles. Surveyed, but not presently scheduled for construction, is a haul road from U.S. Highway No. 16 in the south to Willow Park Reservoir.

U.S. Highways No. 16 and No. 14 are kept open all year, but U.S. Alternate No. 14 is closed by snow between mid-November and the end of May.

Railhead towns in the vicinity include Sheridan, and Ranchester 13 miles to the northwest; both are on the Burlington Northern line from Billings, MT, to Edgemont, SD.

For highway distances from Sheridan to various market centers in the United States, see table 1-2.

Terrain and Soil—As previously noted, the area lies between 6,500 and 9,800 feet elevation. Of the approximately 50,000 acres of lodgepole pine timber type, about nine-tenths have slopes less than 45 percent. The terrain has occasional rock outcroppings, and sizable stones are scattered on the forest floor. Undergrowth is light. Soils are fast draining, of granitic origin, and lack the volcanic ash layer frequently found in lodgepole areas to the north and west. Except for distance from roads and the occasional rock outcroppings, there are no special obstacles to harvesting (fig. 8-5).

Annual Precipitation and Duration of Snow-free Season—Annual precipitation is about 15 inches along the eastern border of the area, 20 to 25 inches in most of the area, and up to 30 inches along the western border—most falling as snow.

General Character of the Timber—Almost all of the timber is less than 9 inches in d.b.h., with diameters of 4 to 7 inches predominating. Stocking varies from moderate (fig. 8-6) to dense (fig. 8-7). The stands originated from forest fires during the period from 1870 to 1900. Undergrowth is moderate and down timber not excessive.

Mortality from mountain pine beetle is not evident, but western gall rust and comandra rust are common. There has been no harvesting in the area, not even by producers of crossties. Plans for future harvests are dependent on gaining road access.

Data on Sample Trees—A pair of codominant lodgepole pines $3\frac{1}{2}$ to 4 inches in d.b.h. were destructively sampled from near-level terrain at an elevation of 8,400 feet about $1\frac{1}{2}$ miles northeast of Willow Park Reservoir (fig. 8-7). Some pertinent tree characteristics follow. These tabulated data should not be interpreted as statistically representative of all trees.

See appendix for an explanation of tree selection and procedures for evaluation of mechanical properties in compression parallel to the grain at 10 percent moisture content.

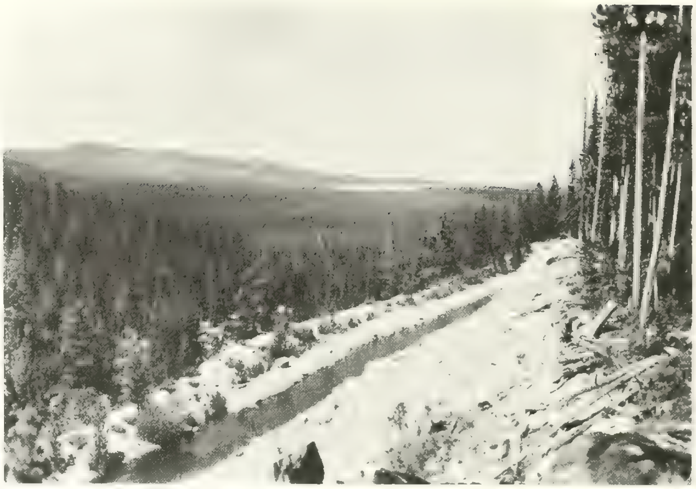

Figure 8-5—View from 1 mile north of Willow Park Reservoir in the Bighorn National Forest looking northwest across Ditch Creek into the gentle terrain surrounding Penrose Park, which is visible in the center distant background.

Characteristic	Tree number 1	Tree number 2
D.b.h. (outside bark), inches	3.80	3.60
Tree height above 6-inch high stump, feet	28.8	28.2
Crown ratio, percent	36.2	43.2
Cone serotiny	open	open
Tree age years (number of annual growth rings)		
Stump height	103	108
20 percent of tree height	85	82
Base of live crown	50	64
Diameter inside bark, inches		
Stump height	3.77	3.85
20 percent of tree height	3.35	3.30
Base of live crown	2.30	2.57
Height from stump top to base of crown, inches	220	192
Stem taper inside bark, inches/100 inches		
Below crown	0.67	0.67
Within crown	1.84	1.76
Rings/inch, average for section		
Stump height	55	56
Base of live crown	43	36
Properties of stemwood at 20 percent height		
Moisture content, percent ovendry weight	86.5	86.6
Specific gravity, ovendry weight and green volume	0.419	0.408
Rings/inch in first $1\frac{1}{4}$ inches radius	40	42
Maximum crushing strength, lb f/in^2	5,130	5,350
Proportional limit, lb f/in^2	3,060	3,690
Modulus of elasticity, lb f/in^2	1,110,000	1,190,000
Compression wood evident?	none	none
Spiral grain angle at surface, degrees	0	1
Bark thickness (single), inch	0.15	0.11
Pith eccentricity, inch	0.1	0.1

Inventory Data—Timber in the area has been type mapped, but inventory data are incomplete. Managers responsible for the area estimate stand data typical of the area as follows:

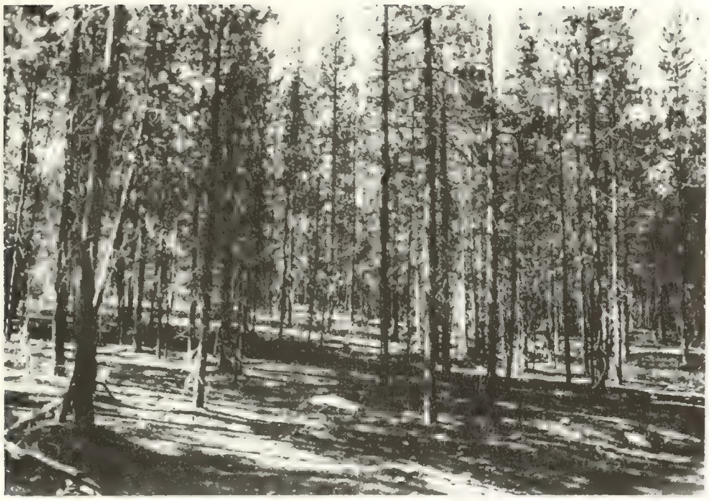

Figure 8-6—Open stand of lodgepole pine on plateau about 6 miles northeast of Willow Park Reservoir along irrigation access road up Little Piney Creek in the Bighorn National Forest.

D.b.h. class	**Live stems per acre (including culls)**	**Average height**	**Age**
Inches	*Number*	*Feet*	*Years*
<2.9	412	10	30
3.0-3.9	208	25	70
4.0-4.9	155	32	75
5.0-5.9	123	36	80
6.0-6.9	106	38	80
7.0-7.9	77	40	85
8.0-8.9	25	44	90
9.0+	23	50	100+
Total	1,129		

Cubic Yield Potential and Height Growth—Managers responsible for the area estimate that in managed stands 80 years old, with stocking of 500 to 600 trees per acre, trees should measure 50 to 55 feet high and 7 or 8 inches in d.b.h.; this translates into an annual growth rate of about 42 ft^3 of stemwood per acre per year. Fifty-year height growth in managed stands is estimated at 40 feet. Current volume growth is about 19 ft^3 per acre per year.

Management Objectives for the Area and Constraints—The area is primarily managed as spring, summer, and fall elk habitat—although it is also heavily utilized as summer pasture for cattle. Utilization for timber is secondary to wildlife considerations. Within this constraint, managers have the objective of creating some stand diversity by phased harvests and stand replacement with vigorous, new, controlled-density stands of lodgepole pine. Appropriately timed, such harvests could enhance elk habitat and preserve watershed, range, and recreational values.

When sales of similar timber are made in the vicinity of the area, dead trees for firewood bring $5 per cord stumpage, and small lodgepole sawtimber stumpage brings $10 or $12 per M bd ft Scribner scale.

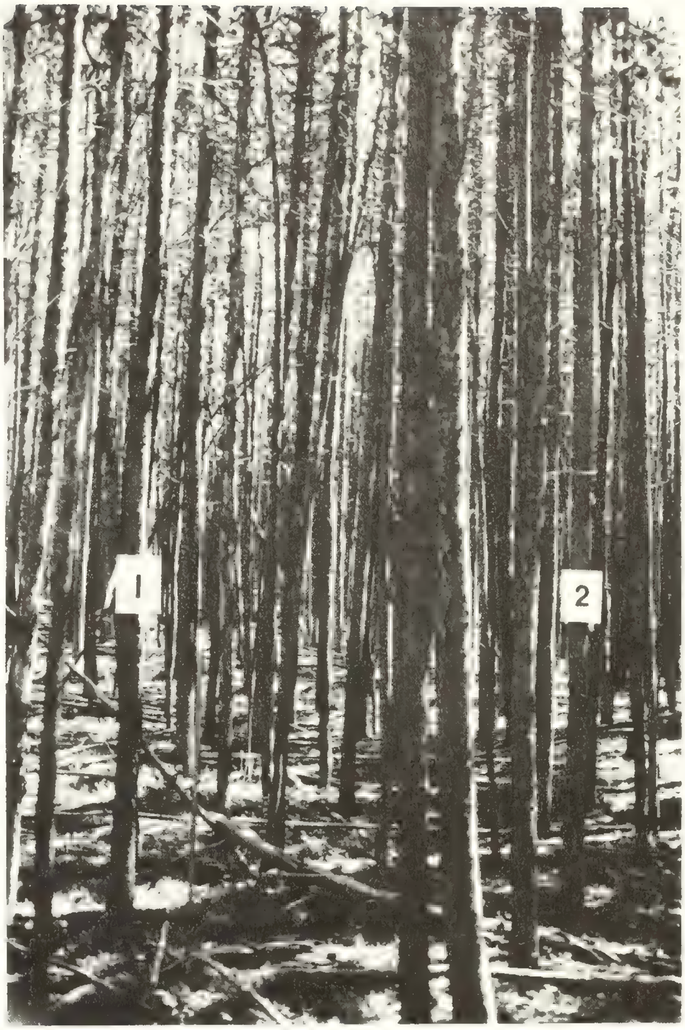

Figure 8-7—Pair of codominant lodgepole pines 3½ to 4 inches in d.b.h. sampled at an elevation of 8,400 feet about 1½ miles northeast of Willow Park Reservoir in the Bighorn National Forest.

Other Lodgepole Pine Available in the Area From Public Lands—On the Bighorn National Forest north of the delineated area there are about 75,000 acres of lodgepole pine timber similar to that within the area. South along U.S. Highway No. 16 there are another 20,000 acres of similar timber. Because the lodgepole pines on these acres are almost all of subsawtimber size, existing mills have little use for them.

Forest Products Industry in the Vicinity—There is only one major sawmill in the area; it is located in Sheridan and manufactures 2- by 4-inch studs, mostly from lodgepole pine. Additionally, there is a small sawmill in Buffalo and a post-and-pole operation in Sheridan. West of the area, another post-and-pole operation is located in Manderson, between Greybull and Worland.

Population in the Vicinity—Johnson County has a total population of 6,850; population of Buffalo, the county seat, is 3,850. Sheridan has a population of 15,146 and Ranchester has 655—all based on 1980 data.

In 1983, per-capita income in Johnson County was $11,496, and in 1986 approximately 8.0 percent of those in the workforce were unemployed.

BRIDGER-TETON NATIONAL FOREST

Area Name and Location—The South Wind River area (figs. 8-8, 8-9, and 8-10), which lies at an elevation of 8,000 to 9,500 feet at latitude 40°37' and longitude 109°13', is in the Pinedale Ranger District of the Bridger-Teton National Forest; the Ranger Station is in Pinedale.

The gross area of 41,000 acres includes more than 10,000 acres of lodgepole pine forest type. Most of the area lies within Sublette County, but the extreme southeastern portion is in Fremont County; Pinedale and Lander, respectively, are the county seats. The area lies just south of the Bridger Wilderness, and the crest of the Wind River Range lies to the northeast (fig. 8-9). The northwest corner of the area is 16 air miles due east of Boulder. Big Sandy Lodge and Campground, near the center of the area, is 75 air miles due north of Rock Springs.

Maps of the Area—USGS quadrangle $7^{1}/_{2}$' maps needed to depict the area are: Pocket Creek Lake, Big Sandy Opening, Leckie, Jensen Meadows, Sweetheart Needles, and Christina Lake.

Access—Forest Service Road No. 116 running north from Dutch Joe Guard Station to Big Sandy Lodge and Campground is the only improved road in the area, although a few unimproved dirt roads approach the perimeter and penetrate some parts (fig. 8-9).

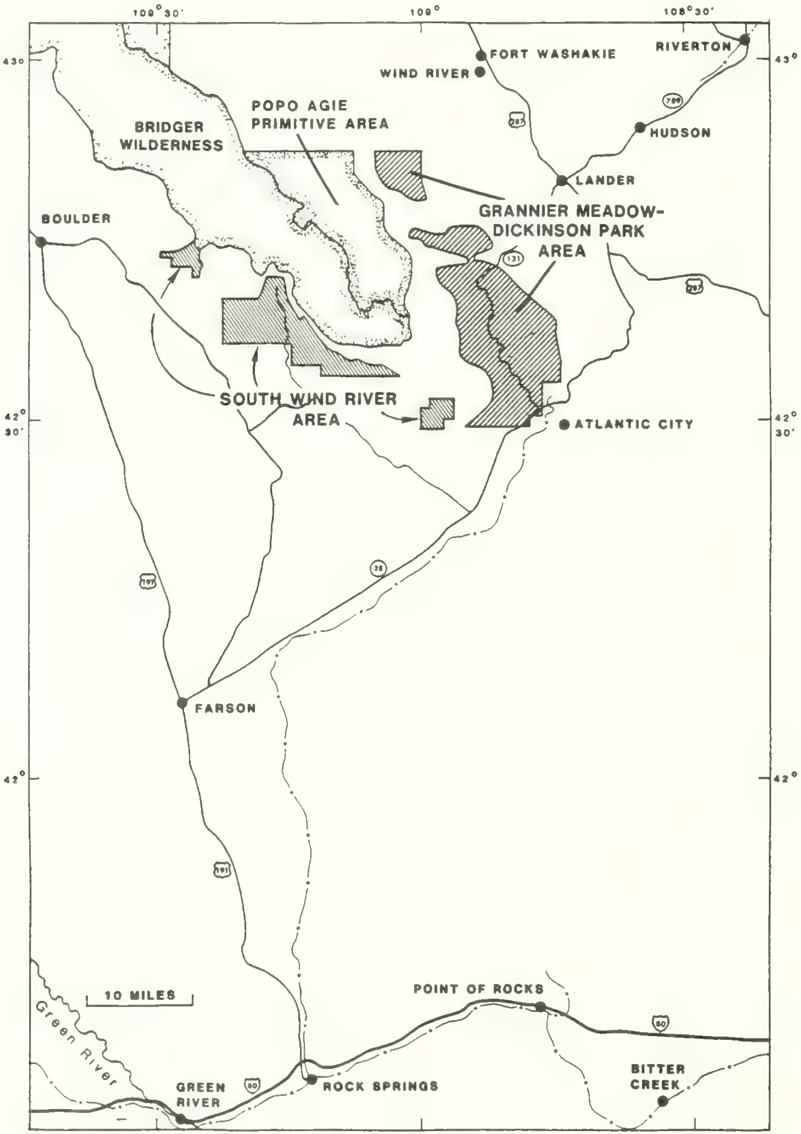

Figure 8-8—Vicinity map for the South Wind River (Bridger-Teton National Forest) and Grannier Meadow-Dickinson Park (Shoshone National Forest) areas of Wyoming. The rail line shown from Rock Springs to Atlantic City is a private line.

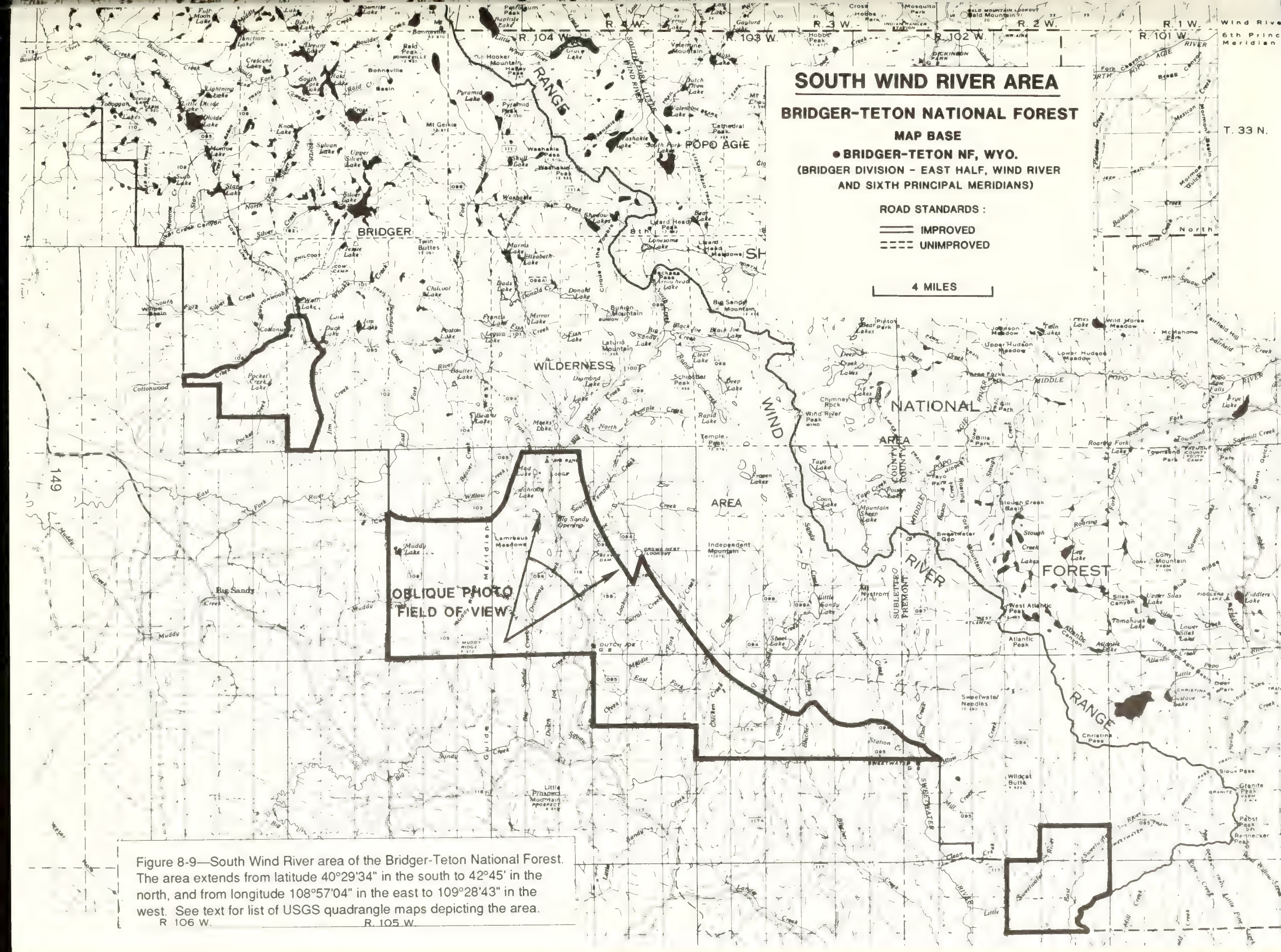

Figure 8-9—South Wind River area of the Bridger-Teton National Forest. The area extends from latitude 40°29'34" in the south to 42°45' in the north, and from longitude 108°57'04" in the east to 109°28'43" in the west. See text for list of USGS quadrangle maps depicting the area.

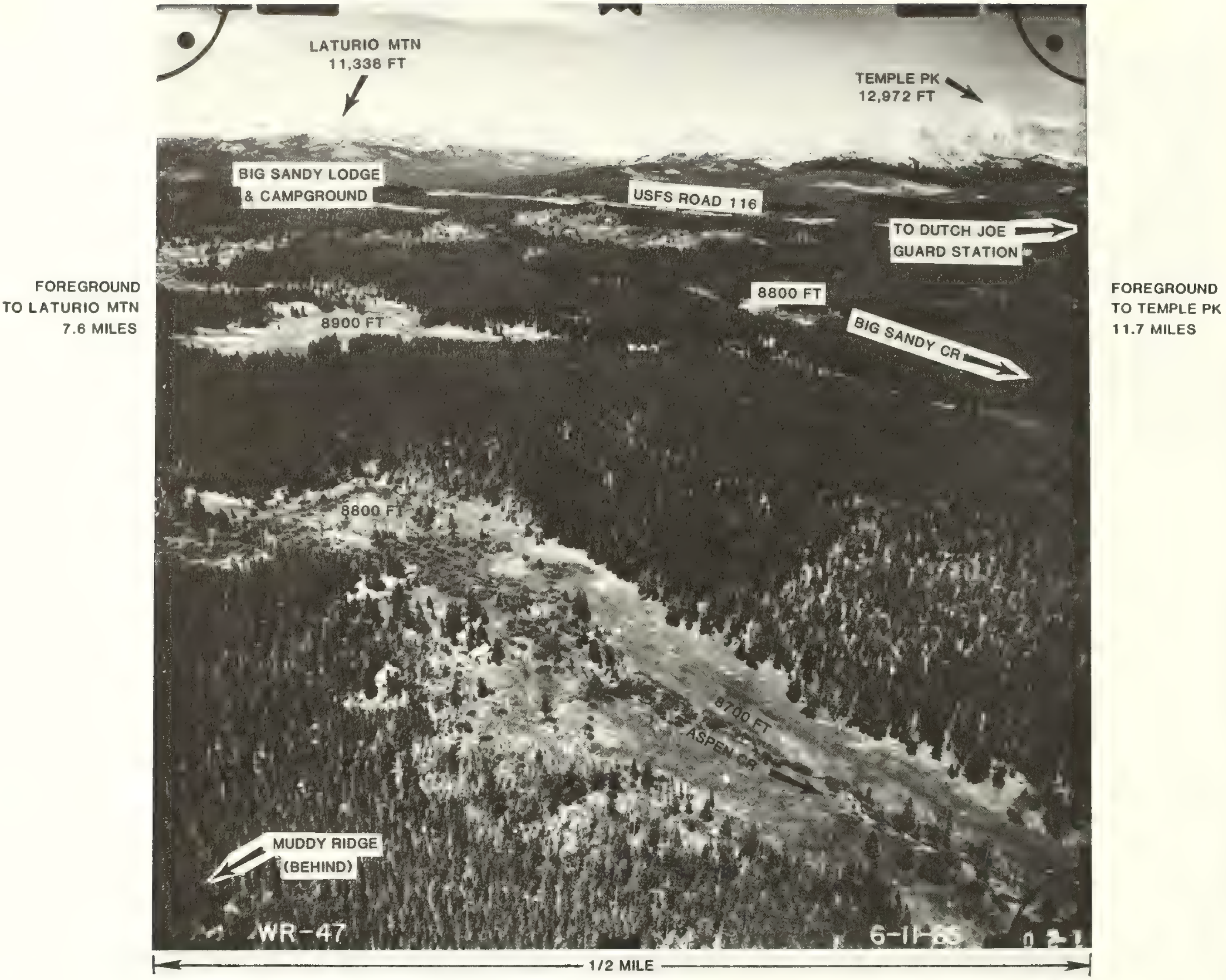

Figure 8-10—Oblique view of the South Wind River area of the Bridger-Teton National Forest looking northeast from near Muddy Ridge toward Big Sandy Opening. See figure 8-9 for camera viewpoint and field. Width of foreground is about one-half mile. From foreground to Laturio Mountain on the left skyline is 7.6 miles and from foreground to Temple Peak is 11.7 miles.

Pinedale (elevation 7,200 feet), 12 miles northwest of Boulder and 100 highway miles north of Rock Springs, is the nearest community of some size; it is 56 road miles from Big Sandy Lodge and Campground. The nearest railhead is on the Union Pacific line at Rock Springs, 98 road miles from Big Sandy Lodge and Campground via Farson (the rail line to Atlantic City, WY, is a private line). For highway distances from Rock Springs to various market centers in the United States, see table 1-2.

Terrain and Soil—As previously noted, the timbered area lies mostly between 8,000 and 9,500 feet, with about three-fourths of the lodgepole pine timber type on slopes of less than 45 percent (fig. 8-10). Soils are shallow granitics containing cobble rocks. Other than remoteness from roads, there are no special obstacles to harvesting. Variable-size bodies of timber are interspersed with meadows.

Annual Precipitation and Duration of Snow-free Season—Annual precipitation totals about 30 inches, most of which falls as snow. Snow accumulation in winter may total 10 feet. The snow-free season generally extends from early June through mid-November.

General Character of the Timber—Trees are mostly 70 to 150 years old, with many stands dating from the last major fire in the area which occurred more than 100 years ago. Typically, stands are deteriorated and not extremely dense (fig. 8-11), although some stagnated, densely stocked sapling/pole stands are present (fig. 8-12). In older stands most stems are larger than 4 inches in d.b.h., and a few are as large as 28 inches. Dead limbs tend to be retained, and crown ratios are relatively large. Stringers of aspen typically run from meadow edges into many of the lodgepole stands (fig. 8-13).

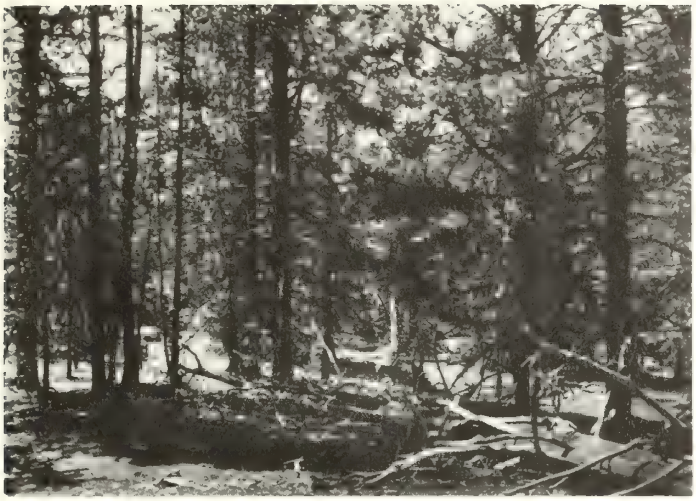

Figure 8-11—Moderately open stand of lodgepole pine of various diameters (up to 28 inches in d.b.h.) about 2 miles south of Big Sandy Campground adjacent to Forest Service Road No. 116 in the South Wind River area of the Bridger-Teton National Forest.

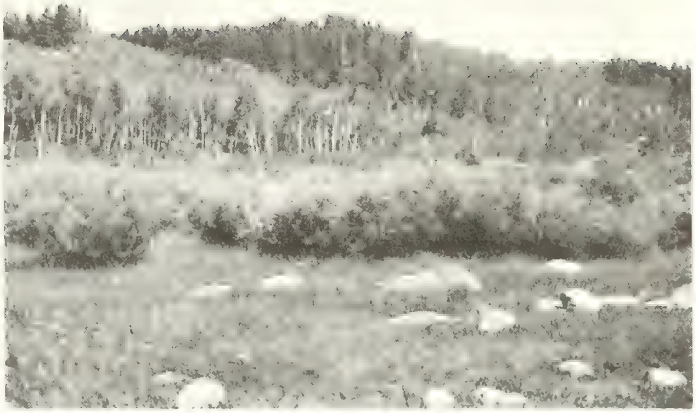

Figure 8-13—Stringers of small aspen among lodgepole pine stands in the vicinity of Dutch Joe Guard Station in the South Wind River area of the Bridger-Teton National Forest.

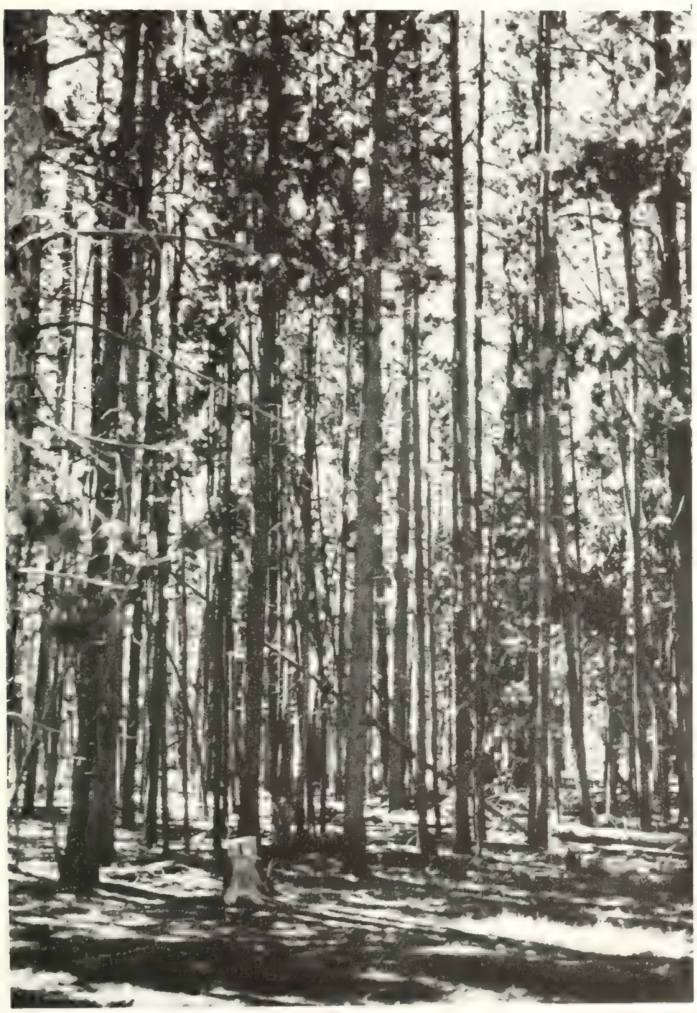

Figure 8-12—Sapling/pole stand of lodgepole pine near Dutch Joe Guard Station in the South Wind River area of the Bridger-Teton National Forest.

Attacks by mountain pine beetles over the years account for some of the size diversity within the more open stands (fig. 8-11). The most recent epidemic-size infestation began in 1965 on adjacent Bureau of Land Management lands and has since progressed up various drainages in the area. Dwarf mistletoe is present in many stands.

More than 20 years ago there were some small clearcuts (less than 100 acres) made in the Muddy Ridge vicinity, and some older partial cuts along the road from Dutch Joe Guard Station to Big Sandy Lodge and Campground. With these exceptions, there has been no harvesting in the area.

Data on Sample Trees—A pair of adjacent codominant lodgepole pines $3^1/_2$ to 4 inches in d.b.h. were destructively sampled at 8,950 feet from nearly level terrain a couple of miles south of Big Sandy Lodge and Campground. Some pertinent tree characteristics follow. These tabulated data should not be interpreted as statistically representative of all trees.

See appendix for an explanation of tree selection and procedures for evaluation of mechanical properties in compression parallel to the grain at 10 percent moisture content.

Characteristic	Tree number 1	Tree number 2
D.b.h. (outside bark), inches	3.80	3.75
Tree height above 6-inch high stump, feet	38.5	37.3
Crown ratio, percent	81.8	77.9
Cone serotiny	open	closed
Tree age years (number of annual growth rings)		
Stump height	92	92
20 percent of tree height	65	61
Base of live crown	67	61
Diameter inside bark, inches		
Stump height	3.85	3.90

Characteristic	Tree number 1	Tree number 2
20 percent of tree height	3.37	3.38
Base of live crown	3.45	3.33
Height from stump top to base of crown, inches	84	99
Stem taper inside bark, inches/100 inches		
Below crown	0.48	0.58
Within crown	0.91	0.96
Rings/inch, average for section		
Stump height	48	47
Base of live crown	39	37
Properties of stemwood at 20 percent height		
Moisture content, percent ovendry weight	106.2	128.6
Specific gravity, ovendry weight and green volume	0.378	0.366
Rings/inch in first $1^1/_4$ inches radius	37	31
Maximum crushing strength, lb f/in^2	4,940	4,510
Proportional limit, lb f/in^2	2,890	2,720
Modulus of elasticity, lb f/in^2	880,000	780,000
Compression wood evident?	none	slight
Spiral grain angle at surface, degrees	0	0
Bark thickness (single), inch	0.12	0.08
Pith eccentricity, inch	0.1	0.3

Inventory Data—Inventory data on the area are incomplete. At considerable risk of oversimplification, managers responsible for the area estimate that of the more than 10,000 acres of lodgepole pine forest type, about 80 percent are in seedling/pole stands and the remainder in stands of larger trees—most of the latter typified by figure 8-11. Typical stand data for these two types are estimated by the managers to be about as follows:

D.b.h. class	Seedling/ pole stands	Larger-tree stands
Inches	*Number of live stems per acre*	
<2.9	100	—
3.0-3.9	150	—
4.0-4.9	150	—
5.0-5.9	200	—
6.0-6.9	200	—
7.0-7.9	150	—
8.0-8.9	50	15
9.0+	—	210
Total	1,000	225

Cubic Yield Potential and Height Growth—Although data are not well documented, managers responsible for the area estimate that in managed stands growth rate in the area should be about 85 ft^3 of stemwood per acre per year. Fifty-year height growth in managed stands is estimated to be about 45 feet.

Management Objectives for the Area and Constraints—The area is primarily managed as elk habitat; also, portions of it are much used for recreation. Utilization for timber in some portions of the area is therefore secondary. Within these constraints, managers have the objective of creating some stand diversity by phased harvests and stand replacement with naturally regenerated, vigorous, controlled-density stands of lodgepole pine. Appropriately timed, such harvests could enhance elk habitat and preserve watershed, range, and recreational values.

The major obstacle to accomplishment of this objective is lack of markets for subsawlog-size stumpage.

Other Lodgepole Pine Available in the Area From Public Lands—If product values were sufficient to justify long log hauls, a plant at Rock Springs might draw on lodgepole pine acreages on the Ashley National Forest in Utah and, possibly, that portion of the Shoshone National Forest just east of the South Wind River area.

Forest Products Industry in the Vicinity—Aside from some small post-and-pole operations, there are no major wood processing facilities in the vicinity of the South Wind River area.

Population in the Vicinity—The population of Sublette County is 4,600; Pinedale, the largest community and the county seat, has a population of 1,067 (based on 1980 data). In 1984, per-capita income in Sublette County was $12,077; in 1985, 4.9 percent of those in the workforce were unemployed. These latter two statistics were favorably influenced by a large construction project in the county during 1984 and 1985.

Rock Springs, with a population (1986) of 20,812, is the largest community in Sweetwater County (population 44,739). In 1985, 7.4 percent of those in the workforce in Sweetwater County were unemployed. Per-capita income in the county was $12,227 in 1984.

MEDICINE BOW NATIONAL FOREST

Area Name and Location—The Upper Pelton Creek area (figs. 2-17, 8-14, and 8-15), which lies at an elevation of 8,400 to 9,400 feet at latitude 41°03' and longitude 106°12', is in the Laramie Ranger District of the Medicine Bow National Forest; the Ranger Station is in Laramie.

The gross area of 7,880 acres includes about 7,100 acres of lodgepole pine timber type and falls entirely within Albany County; Laramie is the county seat. The area is centered around Illinois Creek and the Pelton Creek north drainage. It lies immediately north of, and adjoins, the Colorado border where Wyoming State Highway No. 230 crosses into Colorado. From Laramie, the center of the area is 40 air miles southwest on a heading of 240°. The midpoint of the north border is 4 air miles due west of Foxpark.

Maps of the Area—USGS quadrangle $7^1/_2$' maps needed to depict the area are: Foxpark, WY; Kings Canyon, CO-WY; Northgate, CO-WY; and Horatio Rock, WY-CO.

Access—All-weather paved Wyoming State Highway No. 230 leads 44 miles southwest from Laramie to the southern border of the area, from whence improved Forest Service Road No. 898 forms the southwest border of the area. Improved roads provide access to the southeast portion of the area, traverse the middle of the area from west to east, and

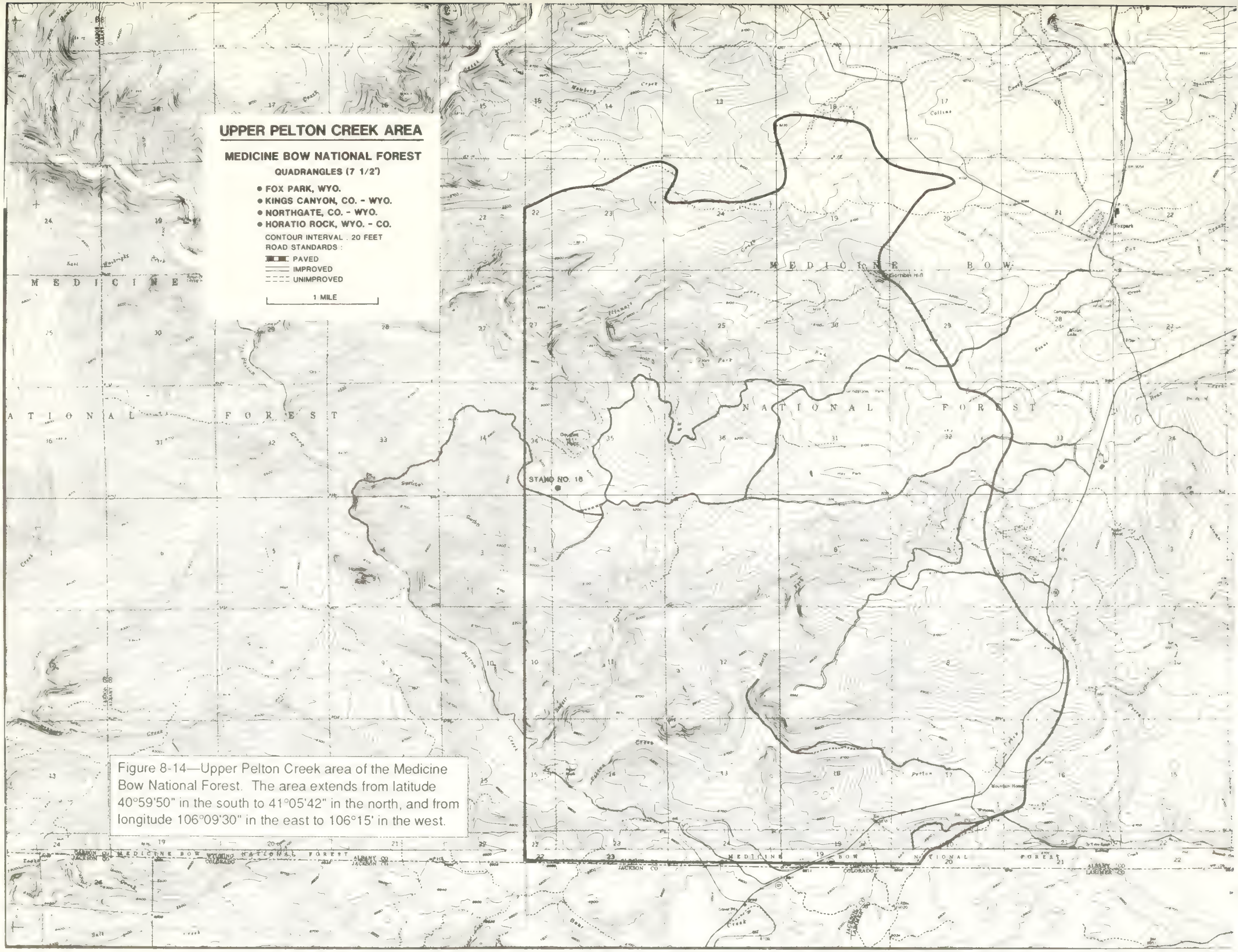

Figure 8-14—Upper Pelton Creek area of the Medicine Bow National Forest. The area extends from latitude 40°59'50" in the south to 41°05'42" in the north, and from longitude 106°09'30" in the east to 106°15' in the west.

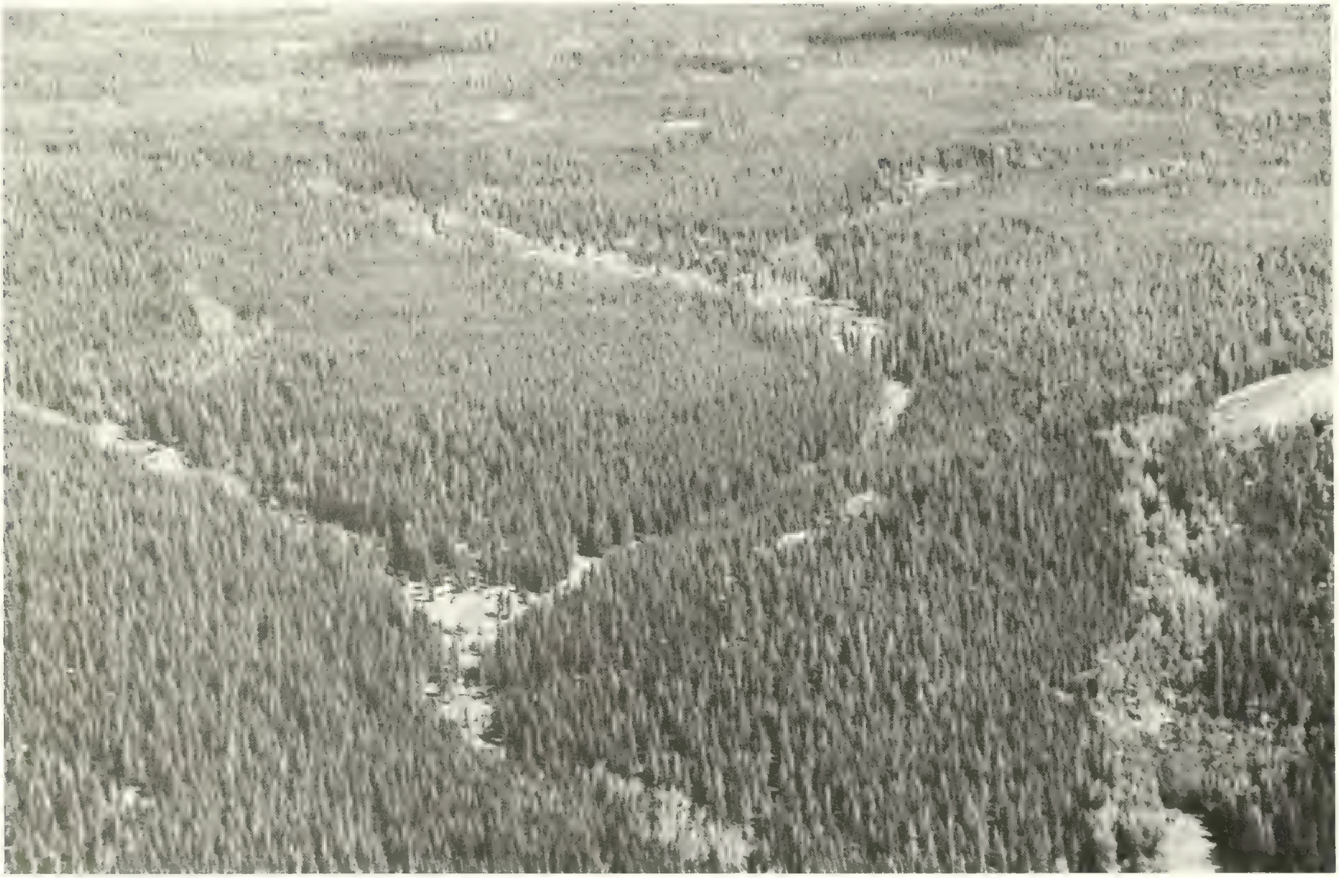

Figure 8-15—Oblique view of typical terrain and vegetation on the 9,000-foot plateau comprising the Upper Pelton Creek area of the Medicine Bow National Forest.

connect with State Highways No. 230 to the east and No. 130 to the north (fig. 8-14). From just south of Douglas Point it is 6 road miles to Foxpark and 30 road miles to State Highway No. 130 just east of Centennial; from this junction to Laramie is an additional 26 miles.

A Union Pacific branch line from Walden, CO, to Centennial, WY, passes through Foxpark and along the east border of the area. Laramie is the nearest sizable railhead community and is on a main line of the Union Pacific. For highway distances from Laramie to various market centers in the United States, see table 1-2.

Terrain and Soil—As previously noted, the area lies between 8,400 and 9,400 feet elevation, with more than four-fifths of the acreage having slopes of less than 45 percent; average slope for the area is about 15 percent. In many parts of the area there is little forest-floor vegetation (figs. 8-16 and 8-17) soils; elsewhere, grass and grouse whortleberry are plentiful. There is no volcanic ash layer forming topsoil. Except that timber from steep slopes must be logged uphill to minimize sedimentation in streams below, and to avoid need for roads in riparian areas, there are no special obstacles to harvesting.

Annual Precipitation and Duration of Snow-free Season—Annual precipitation in the area totals 25 to 30 inches, mostly from thunderstorms or falling as snow. To the east at Foxpark, weather data indicate an average of only 17.1 inches of annual rainfall. The snow-free season in the area generally extends from mid-June to mid-October.

General Character of the Timber—Most of the lodgepole pines are 3 to 8 inches in d.b.h. and 35 to 50 feet in height (figs. 8-16, 8-17, and 8-18). Dead limb retention is not excessive, and crown ratios are generally less than 40 percent. Most stands are 60 to 100 years of age, dating from extensive harvesting during the late 1800's and early 1900's for railroad crossties—and also from forest fires during these years.

Forked stems and those with crook probably number less than 10 percent of the live stems. Cankers and damage from porcupines occur on only a small proportion of stems. Currently, mortality from mountain pine beetle is light. Dwarf mistletoe, however, infests a high proportion of all lodgepole pine trees. Cones in many stands are predominantly closed (serotinous), while those in other stands are open.

Because the trees are predominantly of subsawlog-size, no large harvests are planned in the immediate future; some small sales to post-and-pole operators are planned.

Data on Sample Trees—A pair of codominant lodgepole pines $3^1/2$ to 4 inches in d.b.h. were destructively sampled from level terrain at 9,100 feet elevation just south of

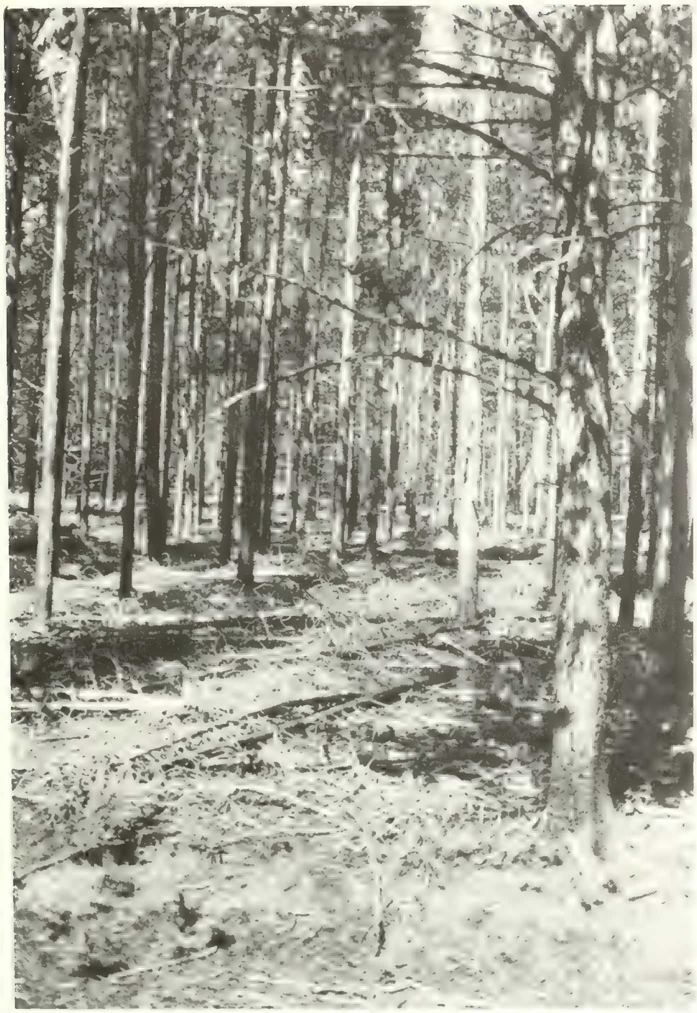

Figure 8-16—Lodgepole pines—mostly 3 to 8 inches in d.b.h.—with little ground vegetation at 8,700 feet along the North Fork of Pelton Creek in the Medicine Bow National Forest.

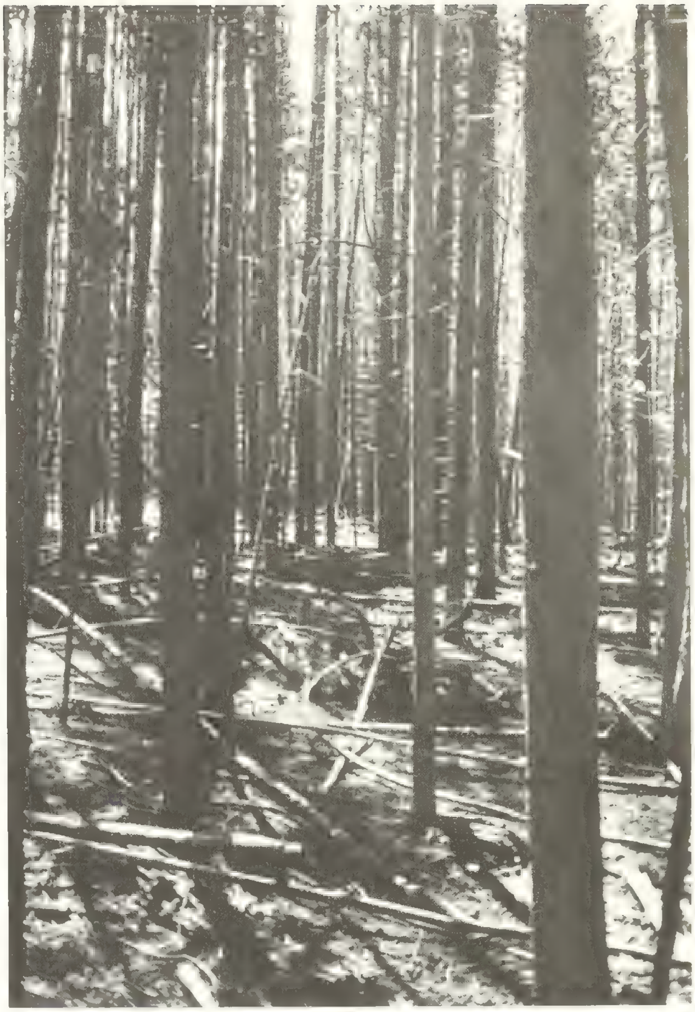

Figure 8-17—Light component of dead wood on ground typical of lodgepole pine stands in the southeast portion of the Upper Pelton Creek area of the Medicine Bow National Forest. Largest trees measured 9 inches in d.b.h. and were about 90 years old; most were 3 to 8 inches in d.b.h.

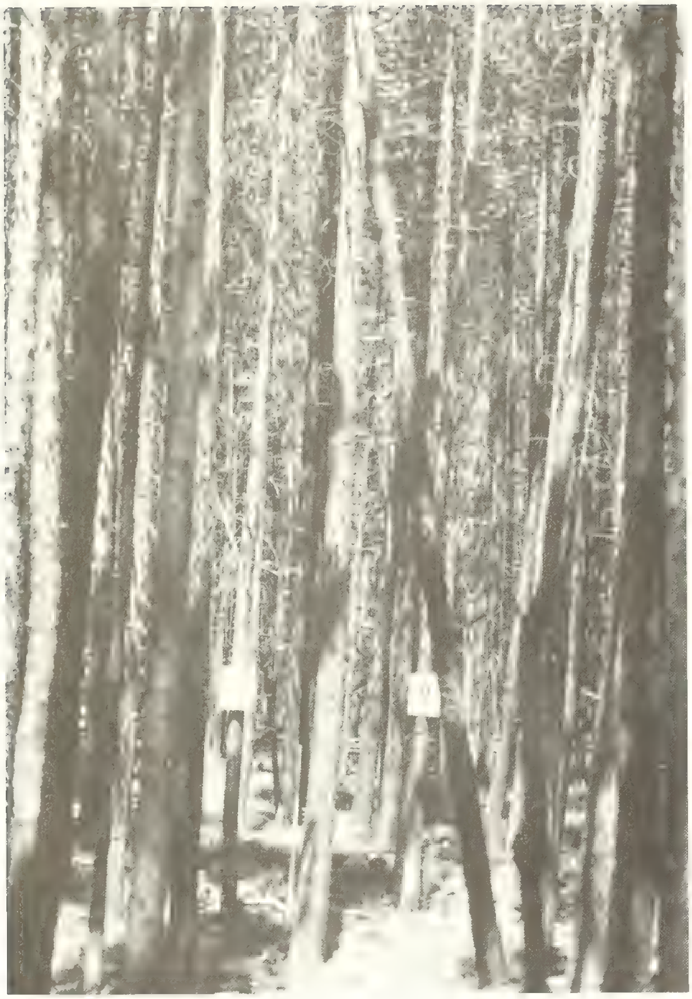

Figure 8-18—Pair of codominant lodgepole pines $3\frac{1}{2}$ to 4 inches in d.b.h. sampled at 9,100 feet elevation from Stand #16 just south of Douglas Point in the Upper Pelton Creek area of the Medicine Bow National Forest.

Douglas Point (fig. 8-18). Some pertinent tree characteristics follow. These tabulated data should not be interpreted as statistically representative of all trees.

See appendix for an explanation of tree selection and procedures for evaluation of mechanical properties in compression parallel to the grain at 10 percent moisture content.

Characteristic	Tree number 1	Tree number 2
D.b.h. (outside bark), inches	3.87	3.87
Tree height above 6-inch high stump, feet	38.2	39.0
Crown ratio, percent	36.6	28.6
Cone serotiny	closed	closed
Tree age years (number of annual growth rings)		
Stump height	100	103
20 percent of tree height	90	84
Base of live crown	59	41
Diameter inside bark, inches		
Stump height	3.80	3.90
20 percent of tree height	3.53	3.29
Base of live crown	2.44	1.93
Height from stump top to base of crown, inches	289	334
Stem taper inside bark, inches/100 inches		
Below crown	0.47	0.53
Within crown	1.44	1.44
Rings/inch, average for section		
Stump height	51	53
Base of live crown	48	42
Properties of stemwood at 20 percent height		
Moisture content, percent ovendry weight	89.7	88.4
Specific gravity, ovendry weight and green volume	0.430	0.418
Rings/inch in first $1\frac{1}{4}$ inches radius	32	32
Maximum crushing strength, lb f/in^2	5,500	6,230
Proportional limit, lb f/in^2	4,120	5,520
Modulus of elasticity, lb f/in^2	1,160,000	1,420,000
Compression wood evident?	none	none
Spiral grain angle at surface, degrees	0	4
Bark thickness (single), inch	0.13	0.13
Pith eccentricity, inch	0.3	0.4

Inventory Data—Inventory data on the area are incomplete, with completion planned by 1990. As noted previously, most of the lodgepole pine in the area is of subsawlog size. Live lodgepole pine stems in one unthinned 46-acre stand south of Douglas Point (Stand #16) were estimated to have a diameter distribution as follows:

D.b.h. class	Number of stems per acre
Inches	
<3.0	0
3.0-4.9	100
5.0-6.9	260
7.0-8.9	288
9.0-10.9	12
11.0+	0
Total	660

It seems likely that this stand had a smaller than typical component of stems smaller than 3 inches in d.b.h.

Cubic Yield Potential and Height Growth—Although data are not well documented, area managers estimate that current lodgepole pine stands are currently growing at a rate of about 30 ft^3 of stemwood per acre per year; the potential is estimated at 50 ft^3 per acre per year. Fifty-year height growth in managed stands is estimated to be 30 to 40 feet.

Management Objectives for the Area and Constraints—The primary objective is phased harvest of the stagnated stands and natural regeneration with vigorous, new, controlled-density lodgepole stands. Appropriately timed, such harvests should enhance elk and deer habitat and protect watershed and recreational values.

The principal obstacle to achievement of objectives is the lack of markets for the typically small lodgepole pine trees. Small-sawlog stumpage currently sells for about $6 per M bd ft Scribner scale, although higher prices have been obtained in the past. Posts and poles bring about $100 per acre, and firewood stumpage sells for $5 per cord. Lodgepole pines for Christmas trees sell for $3 each, on the stump.

Other Lodgepole Pine Available in the Area From Public Lands—In addition to the 7,100 acres of lodgepole pine timber type in the Upper Pelton Creek area, the Medicine Bow National Forest has approximately 25,000 additional acres of similar lodgepole pine within a 75-mile haul radius of Foxpark. Also, the Routt National Forest in Colorado has significant acreages of lodgepole pine, but the extent was not investigated.

Forest Products Industry in the Vicinity—In the immediate vicinity, there is a medium-size sawmill in Foxpark. More distant are larger mills in Laramie, Walden, Encampment, and Saratoga. All of these sawmills manufacture random-length dimension lumber.

Also in Laramie is a post-and-pole operation. There is a structural flakeboard plant 140 miles south in Kremmling, CO.

Population in the Vicinity—In 1984 Albany County had a population of 29,833. Laramie, the largest town in the county, and the county seat, has a population of 25,723 (based on 1984 data). The University of Wyoming, with approximately 10,000 students, is located in Laramie.

Per-capita income in Albany County was $11,013 in 1984, and 4.6 percent of those in the workforce were unemployed in 1985.

SHOSHONE NATIONAL FOREST

Area Name and Location—The Grannier Meadow-Dickinson Park area (figs. 8-8, 8-19, and 8-20), which lies at an elevation of 8,400 to 11,000 feet at latitude 42°41' and longitude 108°53', is in the Lander Ranger District of the Shoshone National Forest; the Ranger Station is in Lander.

The gross area of approximately 35,000 acres includes about 20,000 acres of lodgepole pine forest type and falls entirely within Fremont County; Lander is the county seat. The area is centered along a northwest to southeast axis that runs from Dickinson Park in the northwest past Worthen Meadow Reservoir and Louis Lake to Grannier Meadow in the southeast (fig. 8-19). From Lander, it is 16 air miles due west to Dickinson Park in the center of the northwest portion of the area. Atlantic City is 5 air miles due east of the center of the south border of the area.

Maps of the Area—USGS quadrangle $7^1/2$' maps needed to depict the area are: Louis Lake, Christina Lake, Fossil Hill, Cony Mountain, Mount Arter, and Mount Arter SE.

Access—Access to the northernmost border in the vicinity of Dickinson Park is via an all-weather road (which may be closed to logging traffic) leading south through the Wind River Indian Reservation (fig. 8-19); from the north border, a dirt road leads south to Dickinson Park. Acreage to the east of Petes Lake northwest of Sinks Canyon can be reached on a dirt road, which may be closed because it runs through private land.

The major acreage lies south of Sinks Canyon. A paved road runs 8 miles southwest from Lander (elevation 5,400 feet) to the Sinks Canyon Campground (7,000 feet), from whence an all-weather road (State No. 131) climbs south for another 11 miles to about 8,600 feet at the junction with a dirt road leading a couple of miles west to Worthen Meadow Reservoir. From this junction it is 15 miles south via No. 131 past Louis Lake to State Highway No. 28 at the southernmost border of the area (at an elevation of 8,400 feet and near Atlantic City).

The nearest active railhead is at Riverton, 23 highway miles northeast of Lander, on a branch line connected to the Burlington Northern rail line at Shoshone. There is a private rail line from Rock Springs to Atlantic City (fig. 8-8), but it is inactive.

For highway distances from Riverton to various market centers in the United States, see table 1-2.

Terrain and Soil—As previously noted, the area lies mostly between 8,400 and 11,000 feet elevation, with about three-fifths of the area having slopes of less than 45 percent. In most areas the forest floor is littered with boulders and large stones (fig. 8-21), and rocky outcroppings and slopes are prevalent.

Annual Precipitation and Duration of Snow-free Season—Annual precipitation averages about 20 inches. The snow-free season usually extends from late June to the second week in October.

General Character of the Timber—The lodgepole pine stands are typically 80 to 150 years old. Most trees are shorter than 45 feet. Typically there are 100 to 400 live trees per acre smaller than 3 inches in d.b.h. Trees larger than 3 inches in d.b.h. number from about 250 to 650; of these, more than half are less than 7 inches in d.b.h., and only 35 to 85 are larger than 9 inches in d.b.h. (table 8-3; fig. 8-21). In many stands, trees tend to retain dead branches. Also, small aspen trees and other species are intermingled with lodgepole in many stands.

Overall, the lodgepole timber is of lower quality than that found on most of the areas studied. Examination of stumps suggested, however, that even though current tree quality is not high, managed stands might afford satisfactory diameter growth (fig. 8-22).

Mountain pine beetle attacks began about 1970 near the south border of the area and have progressed north to Sinks Canyon. Mortality from beetle attacks has been heavy (as much as 75 percent) at elevations below 9,200 feet. Because of recent and earlier mortality, there are multiple-aged stands as well as the more typical even-aged lodgepole stands.

There has been little harvest activity in the past. Currently, small acreages are harvested annually for firewood (mostly from beetle-killed trees) and for local-use posts and poles.

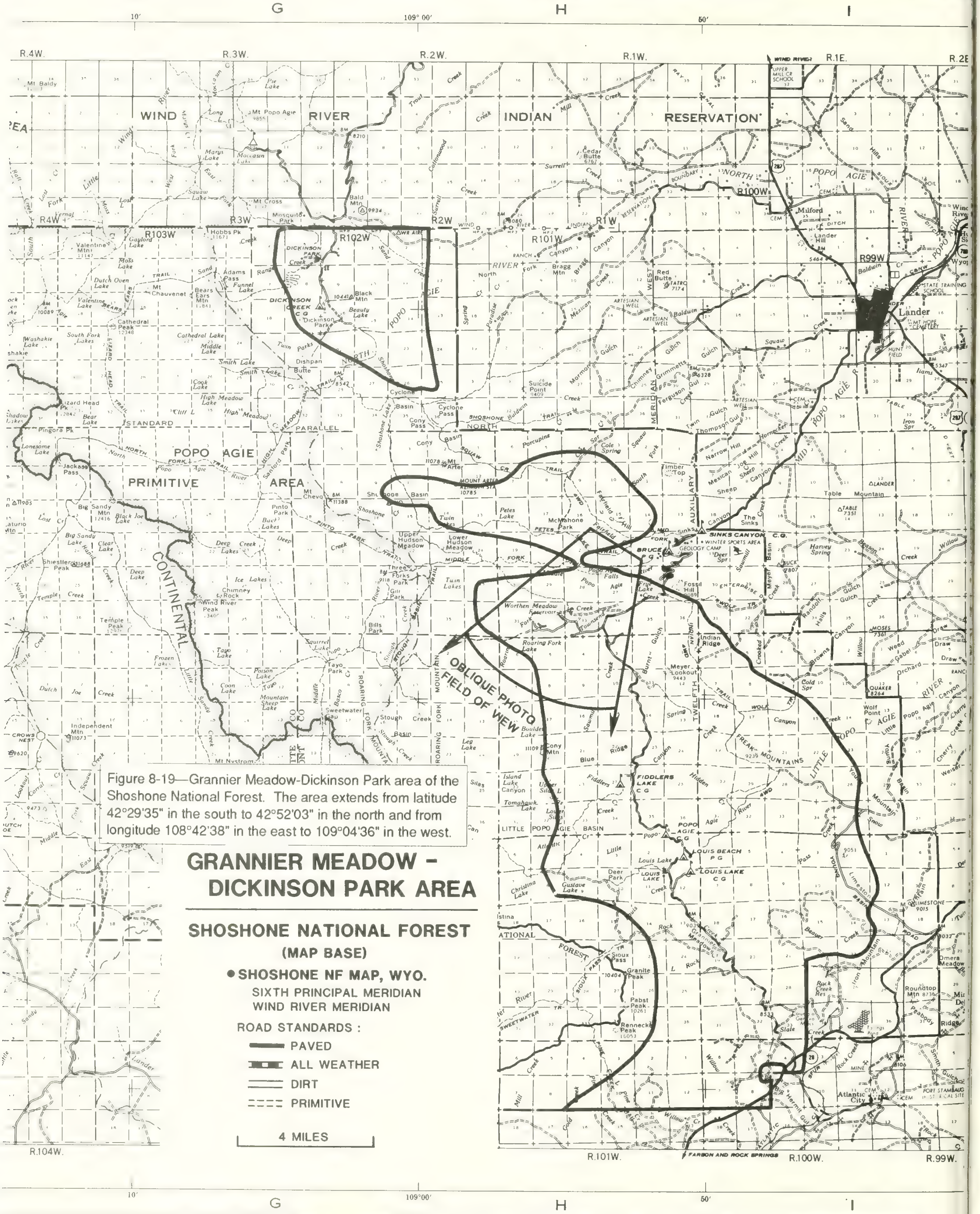
Figure 8-19—Grannier Meadow-Dickinson Park area of the Shoshone National Forest. The area extends from latitude 42°29'35" in the south to 42°52'03" in the north and from longitude 108°42'38" in the east to 109°04'36" in the west.

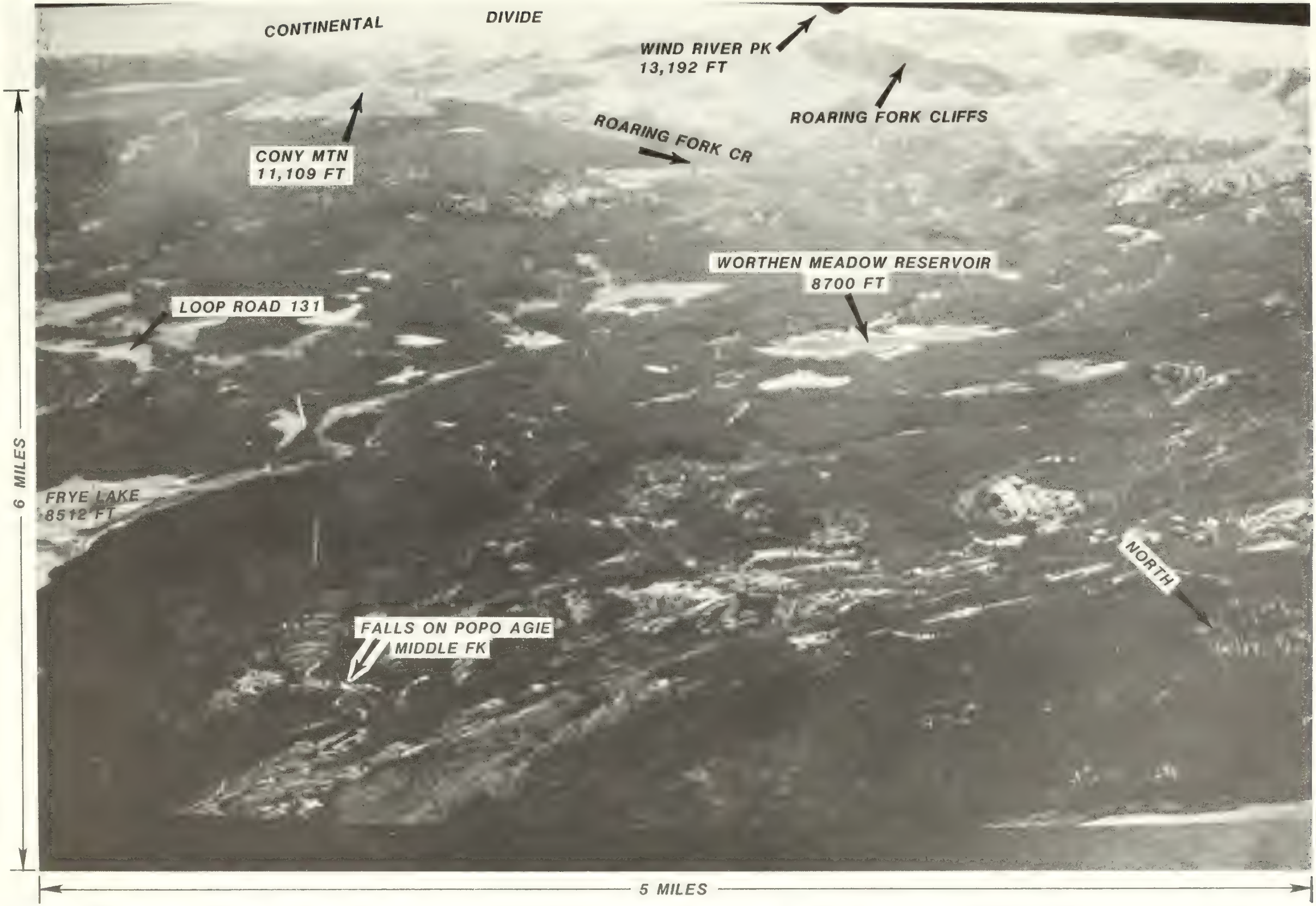

Figure 8-20—Oblique view of the Grannier Meadow-Dickinson Park area of the Shoshone National Forest looking southwest past the falls on the Popo Agie Middle Fork, and over Frye Lake and Worthen Meadow Reservoir toward Cony Mountain and Roaring Fork Creek. See figure 8-19 for camera field of view. Width of foreground is about 5 miles; from foreground to Cony Mountain in the left background is about 6 miles.

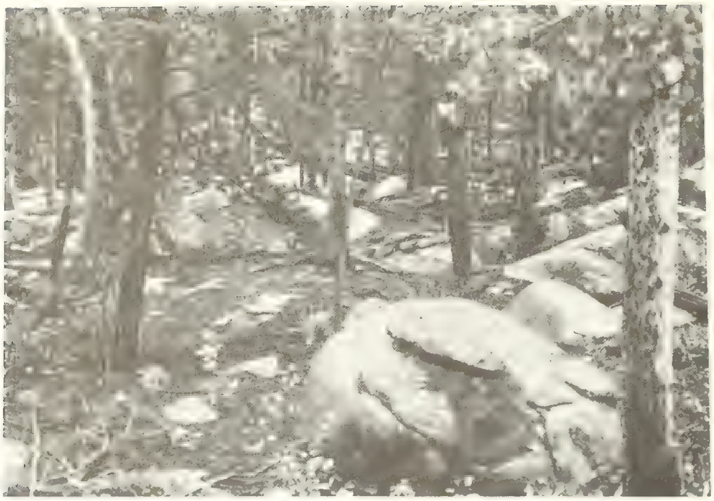

Figure 8-21—Lodgepole pines on typical stony ground immediately south of Worthen Meadow Reservoir in the Grannier Meadow-Dickinson Park area of the Shoshone National Forest.

Table 8-3—Diameter distribution of live trees (mostly, but not all, lodgepole pine) in five typical lodgepole pine type stands of various acreages, stand ages, and classifications on the Lander Ranger District of the Shoshone National Forest

D.b.h. class	#4223 1,126A 80 yr Pole	#4224 4,875A 100 yr Pole	#4225 9,751A 150 yr Overmature	#4226 1,999A 20+ yr Two-aged	#4327 1,139A Overmature diseased
Inches	- - - - - - - -	- - - - - - - -	*Number of trees per acre*	- - - - - - - -	- - - - - - - -
<3.0	367	129	107	225	250
3.0-3.9	198	90	25	27	101
4.0-4.9	127	91	35	23	59
5.0-5.9	149	121	50	27	59
6.0-6.9	79	88	55	27	51
7.0-7.9	42	67	46	38	44
8.0-8.9	17	42	40	24	36
9.0+	36	42	85	76	60
Total	1,015	670	443	467	660

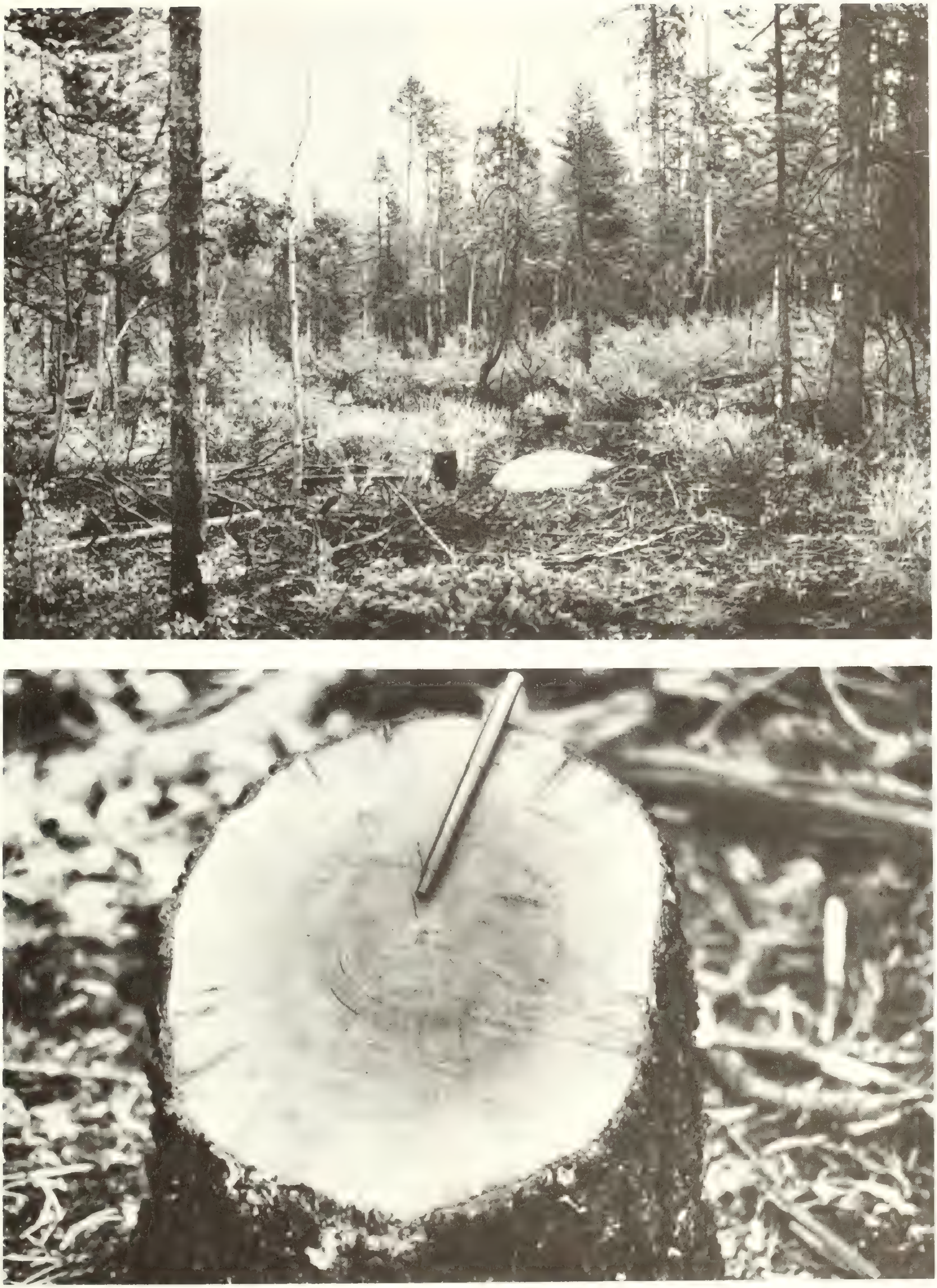

Figure 8-22—At elevation 8,600 feet just east of Frye Lake in the Grannier Meadow-Dickinson Park area of the Shoshone National Forest. (Top) Opening made by firewood cutters removing beetle-killed lodgepole pines. (Bottom) Stump of one of these beetle-killed trees showing uniform fast growth. The pen is 5.3 inches long, and there are 30 annual growth rings showing on the stump.

Data on Sample Trees—A pair of codominant lodgepole pines 3½ to 4 inches in d.b.h. were destructively sampled at 8,600 feet elevation just east of Frye Lake (fig. 8-23). Some pertinent tree characteristics follow. These tabulated data should not be interpreted as statistically representative of all trees.

See appendix for an explanation of tree selection and procedures for evaluation of mechanical properties in compression parallel to the grain at 10 percent moisture content.

Characteristic	Tree number 1	Tree number 2
D.b.h. (outside bark), inches	3.70	3.58
Tree height above 6-inch high stump, feet	29.5	33.0
Crown ratio, percent	46.9	37.6
Crown serotiny	closed	closed
Tree age years (number of annual growth rings)		
Stump height	92	87
20 percent of tree height	78	72
Base of live crown	54	49
Diameter inside bark, inches		
Stump height	3.66	4.22
20 percent of tree height	3.21	3.13
Base of live crown	2.51	2.13
Height from stump top to base of crown, inches	188	247
Stem taper inside bark, inches/100 inches		
Below crown	0.61	0.85
Within crown	1.51	1.43
Rings/inch, average for section		
Stump height	50	41
Base of live crown	43	46
Properties of stemwood at 20 percent height		
Moisture content, percent ovendry weight	85.8	62.2
Specific gravity, ovendry weight and green volume	0.430	0.435
Rings/inch in first 1¼ inches radius	42	28
Maximum crushing strength, lb f/in²	5,000	6,770
Proportional limit, lb f/in²	3,190	4,170
Modulus of elasticity, lb f/in²	1,160,000	1,430,000
Compression wood evident?	none	slight
Spiral grain angle at surface, degrees	1	4
Bark thickness (single), inch	0.12	0.10
Pith eccentricity, inch	0	0.2

Inventory Data—Inventory data on the area are incomplete. Some stand data for lodgepole pine timber type acreages on the Lander Ranger District are presented in table 8-3 as representative of the lodgepole pine within the delineated area.

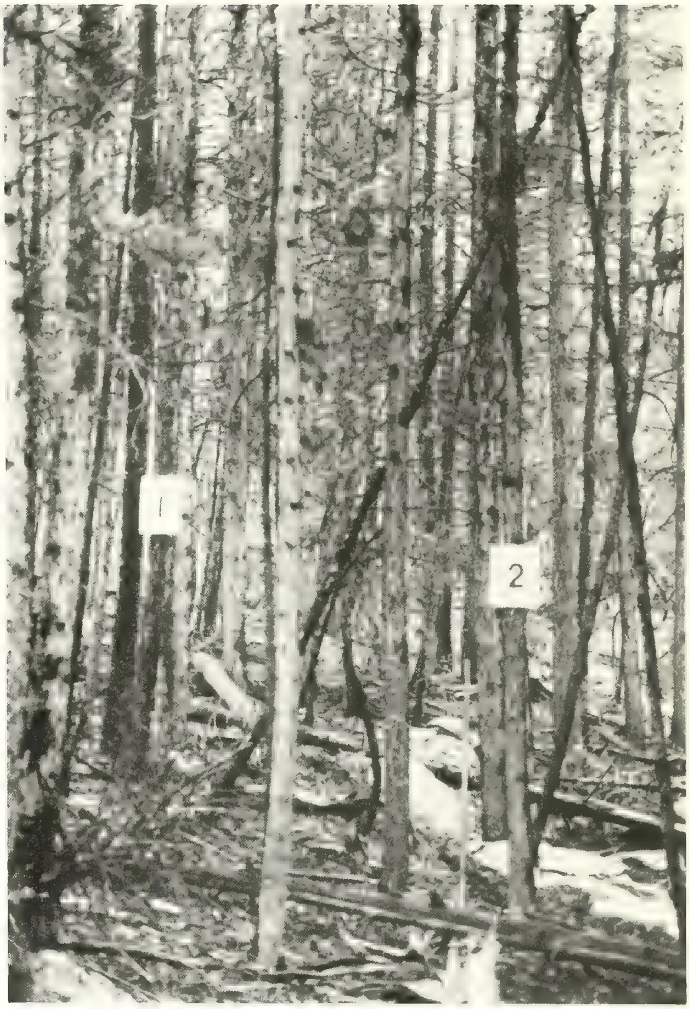

Figure 8-23—Pair of codominant lodgepole pines 3½ to 4 inches in d.b.h. sampled at 8,600 feet elevation just east of Frye Lake in the Grannier Meadow-Dickinson Park area of the Shoshone National Forest.

Cubic Yield Potential and Height Growth—The lodgepole pine acreage within the delineated area is classified as producing 20 ft³ of stemwood per acre per year. Although data are not well documented, managers responsible for the area estimate the potential growth in managed lodgepole stands at 30 ft³ per acre per year. Fifty-year height growth in managed stands is estimated to be 35 to 40 feet.

Management Objectives for the Area and Constraints—The area is heavily used for recreation. Currently the area receives minimum-intensity silvicultural treatment. The Forest Plan projects an annual timber harvest from the area of about 1 million bd ft—half from live timber and half from dead. If suitable markets were available for the lodgepole stumpage, phased replacement of overmature, stagnated, or diseased stands would be desirable. The objective would be natural regeneration of vigorous, controlled-density stands of lodgepole. Appropriately timed, such stand replacements would—in addition to aiding local economies—enhance wildlife habitat and preserve watershed, range, and recreational values.

The principal obstacle to attainment of management objectives is lack of markets for the small-diameter, low-quality trees typical of the area—partially attributable to the difficult rocky terrain and lack of convenient access.

Other Lodgepole Pine Available in the Area From Public Lands—On the entire Shoshone National Forest there are about 144,000 acres of lodgepole pine timber type; only about 86,000 acres sustain a growth rate rapid enough to be classified as suitable for commercial forest. As noted under discussion of the South Wind River area, significant acreages of lodgepole pine timber type are found on the southern end of the Bridger-Teton National Forest across the Continental Divide west of the Grannier Meadow-Dickinson Park area.

Also, the Ashley National Forest, south of Rock Springs, has large acreages of lodgepole pine for which there is little demand.

Forest Products Industry in the Vicinity—There are no major wood-using industries in the immediate vicinity. Cabin log manufacturers are located in Lander and Casper.

Population in the Vicinity—In 1986 Fremont County had a population of about 24,000; Lander, the largest community in the county and the county seat, had a population of 8,254 in 1982. Riverton, the nearest railhead town, had a population of about 9,000 in 1986.

In 1984, annual per-capita income was $10,142 in Fremont County, and 10.4 percent of those in the workforce were unemployed.

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CHAPTER 9: SUMMARY

The 28 acreages visited differ greatly. For example, although most are solidly forested in lodgepole pine, some contain significant components of larch, Douglas-fir, subalpine fir, spruce, or aspen. Meadows and grassy openings are common in the lodgepole pine acreages of Colorado and southern Idaho and Wyoming. Growth potential varies from only slightly more than 20 ft^3 per acre per year to more than 100 ft^3 per acre per year. Annual precipitation varies from a low of slightly less than 20 inches to a maximum of near 60 inches. Terrain varies from nearly level to mostly steep; in aggregate, perhaps two-thirds of the lodgepole pine acreage delineated is on slopes of less than 45 percent. A few of the acreages are stony and boulder strewn, but most are not excessively rocky. Mortality—primarily from mountain pine beetle attacks—varies from the preponderance of stems to virtually none of the stems. Defects in live trees that adversely affect utilization in solid wood products include porcupine scars (in some areas occurring on three-quarters of the stems and at several heights in each stem), stem crook, stem sweep, stem fork, cankers, fire scars, frost cracks, pith eccentricity and excessive compression wood content, excessive spiral grain, excessive taper, and excessive limbiness. Degree of defect varies greatly among and within acreages.

Accessibility of the acreages also varies significantly. Almost all have roads to their perimeters, and most have some interior roads; but a few can be reached only on foot. Most are within 50 miles of a railhead, but a few are more distant.

In virtually all of the acreages, stand type varies in a continuum. Classes of stands include: "dog-hair" stands of trees less than 3 inches in d.b.h., pole stands with all trees live, pole stands with many dead trees, pole stands with dense understories of smaller trees, stands of sparsely stocked small sawtimber (usually older than 200 years), vigorous stands of large pole timber (that is, 6 or 7 inches in d.b.h.), stands of dead trees killed by bark beetles (many of suitable size for cabin logs), and stands of a variety of ages and generally low stocking containing relicts of past insect attacks as well as a range of smaller trees—usually suffering from dwarf mistletoe attack and cankers of various descriptions.

The preponderance of lodgepole cubic volume on the acreages visited is found in trees 3 to perhaps 6½ inches in d.b.h.—trees too small to yield sawlogs. Stands are typically 70 to 100 years old, with a few stands younger than 40 years and some older than 200 years.

In the d.b.h. class from 3½ to 4 inches, trees are generally about 35 feet tall, with few shorter than 22 feet and few taller than 55 feet; stemwood-average specific gravity of such trees ranges from 0.36 to 0.52, but is generally 0.40 to 0.44 (based on ovendry weight and green volume). In trees 3½ to 4 inches in diameter, crown ratios are mostly in the range from 30 to 60 percent, with average slightly less than 50 percent. Below-crown stem taper (inside bark) is generally more than 0.4 and less than 0.8 inch per 100 inches; it averages about 0.6 inch (table 9-1).

Table 9-1—Summary of data descriptive of the pair of trees 3½ to 4 inches in d.b.h. sampled from each of the 28 areas studied

Characteristic	Average	Standard deviation	Range
D.b.h. (outside bark), inches	3.74	0.175	3.26-4.05
Tree height (stump height to apical tip), feet	34.9	7.42	21.8-54.5
Tree age at stump height, years	87.0	38.46	24-240
Crown ratio, percent	46.4	15.81	14.7-81.8
Diameter inside bark			
Stump height, inches	3.84	0.211	3.32-4.28
20 percent of tree height, inches	3.33	0.184	2.82-3.75
Base of live crown, inches	2.54	0.441	1.80-3.45
Stem taper inside bark, inches/100 inches			
Below crown	0.60	0.169	0.30-1.44
Within crown	1.48	0.525	0.83-3.65
Height from stump top to crown base, inches	228	91.6	82-440
Properties of stemwood at 20 percent height			
Moisture content, percent ovendry weight	94.8	21.01	60-158
Specific gravity, ovendry weight and green volume	0.419	0.036	0.359-0.519
Rings/inch in first 1¼ inches radius	33.1	20.40	10-134
Spiral grain at surface, degrees	1.9	1.98	0-8
Pith eccentricity, inch	0.19	0.138	0-0.6
Bark thickness (single), inch	0.12	0.024	0.07-0.20
[1] Maximum crushing strength, thousand lb f/in^2	5.76	0.967	4.28-8.73
[1] Proportional limit, thousand lb f/in^2	3.85	1.039	1.06-6.08
[1] Modulus of elasticity, million lb f/in^2	1.19	0.320	0.64-2.09

[1] See appendix for procedure in obtaining these mechanical properties in compression parallel to the grain of 2¼-inch-diameter dowels (containing knots) at 10 percent moisture content.

In trees 3½ to 4 inches in d.b.h., stemwood moisture content at 20 percent of tree height averages about 95 percent of ovendry weight, with standard deviation of about 21 percentage points. At this height such trees have about 33 rings per inch in the first 1¼ inches of radius (standard deviation of 20 rings per inch), bark thickness of about 0.12 inch (standard deviation of 0.024 inch), spiral grain at the cambium layer of about 1.9° (standard deviation of 1.9°), and pith eccentricity of about 0.19 inch (standard deviation of 0.14 inch). For ranges in these properties, see table 9-1.

Mechanical properties of stemwood sections (taken from trees 3½ to 4 inches in d.b.h. at 20 percent of tree height to include knot clusters) air dried and turned to 2- by 14-inch-diameter dowels varied greatly from area to area, with specimens from Montana trees having highest values (see appendix 1). The 28-area average for modulus of elasticity was 1,190,000 lb f/in^2 (standard deviation of 320,000 lb f/in^2), and the average for maximum crushing strength parallel to the grain was 5,760 lb f/in^2 (standard deviation of 967 lb f/in^2). The foregoing values are for wood with moisture content of 10 percent of ovendry weight. Stem sections with visible compression wood averaged 26 percent lower in modulus of elasticity and 30 percent lower in maximum crushing strength parallel to the grain than those without visible compression wood.

Data from Montana lodgepole stands selected for 1985 thinning studies suggest that an average unthinned acre might contain 1,360 live stems 3 inches in d.b.h. and larger, totaling 3,400 ft^3 of stemwood, or about 43 tons of stemwood (ovendry basis). Considering all of the 28 lodgepole pine stands visited, however, it seems that a more conservative estimate for lodgepole in the Rocky Mountain area might be 1,000 live stems per acre, 3 inches in d.b.h. and larger, totaling 2,500 ft^3 of stemwood, or about 31 tons of stemwood, ovendry. When more accurate inventory data are available, even this lower estimate may prove too high.

On virtually all of the acreages, post-and-pole operators nibble away at the pole stands, each cutting 1 to 3 acres annually in close proximity to existing roads; such post-and-pole operations are sometimes used to achieve cosmetic thinning along these roads. These operators generally pay a stumpage fee of $5 to $10 per thousand lineal feet of product.

In Colorado and southern Wyoming acreages some lodgepole pine Christmas trees are cut annually (personal-use stumpage fee of $3 to $5 per tree). Almost all acreages have a significant market for dead stems sold as firewood ($2.50 to $12.50 per cord stumpage fee). Firewood stumpage values frequently exceed sawlog stumpage values.

Occasionally a sawlog sale of 15 to 500 acres is made, but virtually always at a stumpage cost less than that required to prepare the sale. Sawlog sales of more than 12,000 bd ft per acre are unusual, and stumpage fees usually are in the $6 to $10 range with some sales made at $1 per M bd ft Scribner log scale, and few as high as $25.

Costs of preparing and executing a small-acreage, low-volume sawlog sale, exclusive of road construction costs, vary greatly among forests and also depend on the characteristics of the sale area. Sale costs per thousand board feet of sawlogs are inversely related to sale acreage and to timber volume sold per acre. Sales on the areas studied usually encompass less than 40 acres, with lodgepole pine sawlog volume generally less than 8,000 bd ft per acre.

The direct costs to ranger districts (or equivalent on State or Bureau of Land Management forests) were reported as low as $2 in one area, but more typically are $12 to $25 per M bd ft Scribner scale. When all appropriate direct and indirect costs within ranger districts, supervisors' offices, and regional headquarters are included, however, total sales costs per thousand feet of lodgepole pine sold in small tracts appear to be in the range from $40 to $60, with one forest reporting total costs of $85. Such costs include not only those incurred by technicians, timber sales officers, and road planning engineers, but also those incurred by specialists in silviculture, wildlife habitat, landscape esthetics, watershed quality, archeology, and law (together with all supporting staff in supervisors' and regional foresters' offices).

Volumes of forest residues resulting from sawlog sales in these problem lodgepole pine stands are generally great because most of the sawlog operators have no profitable outlet for subsawlog-size stems.

MANAGEMENT OBJECTIVES AND SILVICULTURAL CONSIDERATIONS

With virtually no exceptions, the land managers have concluded that thinning these more-or-less stagnated stands that are 70 to 100 years old is an uneconomic procedure. This is so because products recovered in such thinning have low value, growth response is not outstanding, and thinning cost is great.

With almost no exceptions, the land managers are seeking some methodology to replace the stagnated and unmarketable stands of lodgepole pine with new vigorous stands of the same species—and they want to do this without expending public money. They visualize that this must be done by phased clearcutting and natural regeneration, but they have very few stumpage purchasers willing to build the necessary temporary roads, clear-fell all diameter classes of all species, and leave the acreage with no more than 25 tons (ovendry) of slash per acre and with sufficient seed distributed on exposed mineral soil to ensure natural regeneration. When the managers contract such stand replacement operations, they incur costs of $200 to $700 per acre—costs that they find hard to economically justify. Most of the managers do not find it necessary to plant such clearcut areas if the seedbed is properly prepared with mineral soil adequately exposed, and if viable seeds are available from serotinous cones on the ground or from adjacent trees bearing open cones.

Assuming that stand replacement can be accomplished with little or no expenditure of public funds, most of the managers think that they can internally fund thinning of the regenerated stands when the trees are 15 to 20 feet tall. Cost of such precommercial thinning is usually $60 to $85 per acre, but may be as high as $300 per acre where growth is dense.

In virtually all cases, the managers must give great consideration to improvement of wildlife habitat, protection of stream quality, and protection of esthetic values—but these considerations are not generally seen as prohibiting planned stand replacement as long as clearcuts do not exceed 40 acres, are spaced to maintain elk or deer hiding cover, do not disturb streams, and are located and contoured to be visually acceptable. This generalization does not apply to two or three of the Wyoming-Colorado areas where recreational use is heavy and where hiding cover for elk is limited to a narrow forest of lodgepole pine bordered by sagebrush below the trees and exposed rock above.

While controlled or wild fire might appear to offer a solution on some acreages, few managers are willing to embrace the idea of deliberately wasting the enormous tonnages of wood that would be consumed by such fires. And such fires would offer limited scope for protecting stream quality, habitat, and esthetic quality of the forest.

MANAGEMENT IMPLICATIONS

In brief, the land manager faces the problem of how to clearcut and regenerate large acreages of stagnated or otherwise unproductive stands of lodgepole pine without expenditure of public funds to cover the direct costs. Managers must accomplish this stand replacement according to a management plan without jeopardizing the other values of the forest—wildlife habitat, stream quality, and esthetic quality. Such stand replacement with vigorous new stands is done in contemplation of thinning to a prescribed stocking density when the new trees attain a height of about 15 to 20 feet. Biomass resulting from the clearcuts should yield a positive contribution to the economy—as contrasted to waste through destruction by fire or by insects and disease.

At the same time, the industrial manager of the manufacturing operation performing the clearcuts, site preparation, and utilization of the material removed faces the problem of making an appropriate profit on investment in harvesting, transport, and conversion facilities. This after-tax return should be at least 15 percent annually on the entire investment, assuming no borrowed funds.

APPENDIX: PROCEDURE AND RESULTS OF COMPRESSION TESTS

One of the most promising uses of small-diameter lodgepole pines is as pith-centered dowels for structural purposes (Koch and Burke 1985). The 56 trees sampled (dominant and codominant where possible) were selected in a narrow range of diameters from 3½ to 4 inches in d.b.h. because this diameter class represents a major unutilized portion of most lodgepole pine forests, and because trees from this size class can be used in the joists described by Koch and Burke (1985).

Procedure

To provide some statistical data descriptive of mechanical properties of such dowels, a 9-inch-long stem section was removed at 20 percent of tree height from each of the 56 trees. This height was selected because previous research (Koch 1987) showed that the specific gravity of stemwood sampled at 20 percent of tree height closely approximates the average for entire stemwood.

These stem sections were debarked, air dried, lathe-turned to 2¼ inches in diameter, and square-end trimmed to remove chuck marks.

All but two of the turned specimens (Caribou-1 and Gallatin-1) included knot clusters. No knots exceeded 0.5 inch in diameter, and most measured 0.2 to 0.3 inch in diameter. Most were sound red knots, but some were encased.

At test, the specimens averaged 8.2 percent moisture content (based on ovendry weight), with standard deviation of 0.63 percentage point and range from 6.4 to 9.5 percent. Of the 56 specimens, 30 had at least one drying check and 26 were check free.

Compression wood—usually formed by accelerated growth on the lower side of inclined stems, and causing an eccentric pith—was readily visible in 14 of the 56 specimens, as follows. The terms "slight," "significant," and "much" denote increasing degrees of compression wood presence (fig. AP-1):

Colorado	
Gunnison-1	(slight)
Gunnison-2	(slight)
BLM-2	(slight)
Idaho	
Challis-1	(slight)
Challis-2	(slight)
Panhandle-1	(significant)
Panhandle-2	(significant)

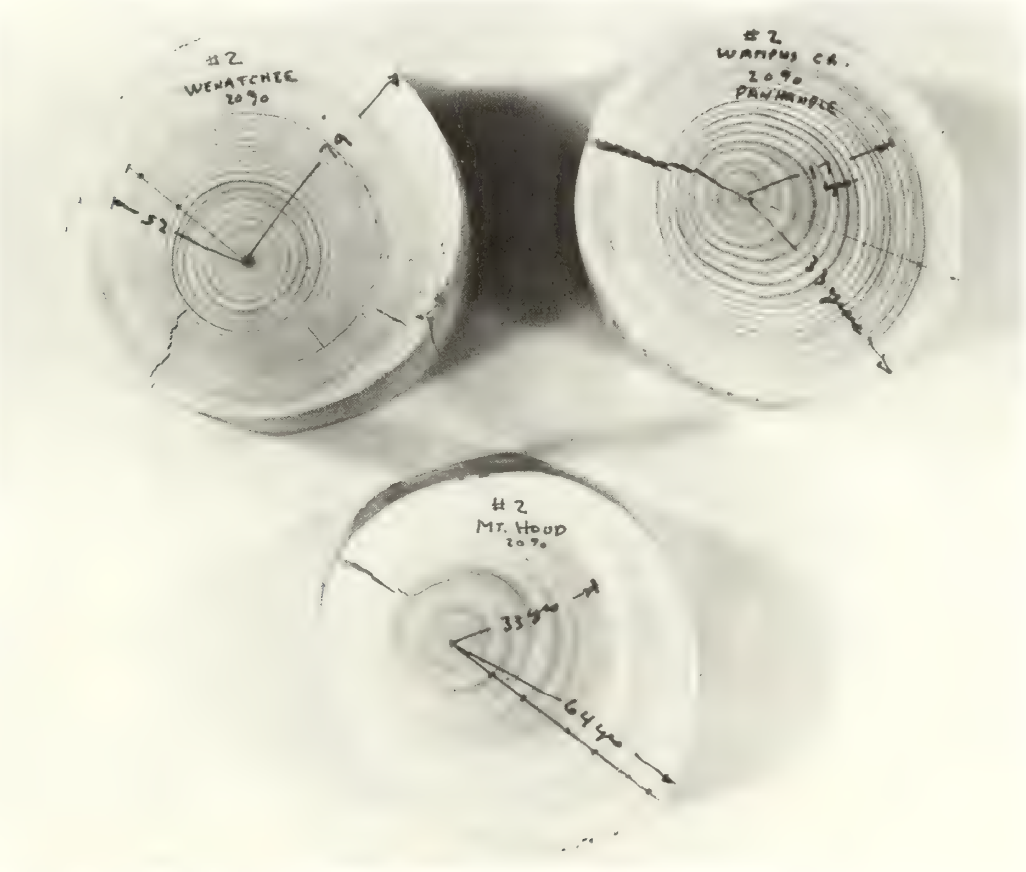

Figure AP-1—Three degrees of compression-wood presence in specimens taken at 20 percent of tree height. (Top left) Slight. (Top right) Significant. (Bottom) Much. The specimens are about 3.4 inches in diameter.

Oregon	
Fremont-1	(slight)
Fremont-2	(significant)
Mount Hood-1	(much)
Mount Hood-2	(much)
Washington	
Wenatchee-2	(slight)
Wyoming	
Bridger-Teton-2	(slight)
Shoshone-2	(slight)

Compresssion tests parallel to the grain were conducted according to ASTM D-198 (ASTM 1972a) on the 60,000-pound universal testing machine of the University of Montana School of Forestry. The machine was fitted with a compressometer with 4-inch gauge length and dial gauge reading to 0.0001 inch. Moisture content at test and specific gravity (based on ovendry weight and volume at test) were determined. The compressometer was placed so that the knot cluster present in each specimen (except Caribou-1 and Gallatin-1, which were knot-free) was within the gauge length.

Values for modulus of elasticity, maximum crushing strength, and proportional limit were adjusted to a specimen moisture content of 10 percent by the procedure specified in ASTM D-2915 (ASTM 1972b).

Results

Mechanical properties, in compression parallel to the grain, of the 56 specimens gathered from the 28 areas in seven States are summarized as follows (values adjusted to a specimen moisture content of 10 percent of ovendry weight):

Property	Average value	Standard deviation	Range
	Lb f/in^2		
Modulus of elasticity	1,190,000	320,000	640,000-2,090,000
Maximum crushing strength	5,760	967	4,280-8,730
Proportional limit	3,850	1,039	1,060-6,080

The data (table AP-1, summarized by State in table AP-2) suggest that mechanical properties in compression parallel to the grain are not closely related to specific gravity, rings per inch, or the presence of drying checks.

Table AP-1—Characteristics of 56 stem sections sampled at 20 percent of tree height, air dried,[1] lathe-turned to 2¼ inches in diameter, and tested in compression parallel to the grain

Specimen number	Compression wood[2] content	Modulus of elasticity	Maximum crushing strength	Proportional limit	Specific gravity[3]	Rings per inch[4]
		Million lb f/in^2	*Lb f/in*^{2}	*Lb f/in*^{2}		
			COLORADO			
Gunnison-1	slight	0.95	5,770	4,270	0.460	112
Gunnison-2	slight	1.33	6,410	5,110	.507	134
Rio Grande-1		.97	5,790	3,610	.477	48
Rio Grande-2		.87	5,250	4,140	.443	36
White River-1		1.15	5,660	3,830	.453	40
White River-2		1.15	6,270	4,640	.494	48
State Forest-1		1.47	6,330	5,500	.467	38
State Forest-2		1.03	5,160	4,540	.449	30
BLM-1		1.06	5,270	3,970	.468	46
BLM-2		1.12	4,990	3,760	.441	30
Average		1.11	5,690	4,337	.466	56.2
Standard deviation		.180	518	613	.022	36.2
			IDAHO			
Caribou-1		1.16	5,930	4,260	0.396	13
Caribou-2		1.22	5,360	3,710	.372	17
Challis-1	slight	.64	4,410	2,280	.419	19
Challis-2	slight	.97	5,550	3,720	.447	24
Nezperce-1		1.42	5,370	3,980	.471	14
Nezperce-2		1.52	6,100	5,120	.467	13
Panhandle-1	significant	.64	4,510	2,720	.428	14
Panhandle-2	significant	1.02	5,060	1,830	.519	14
Payette-1		.98	5,920	4,440	.475	24
Payette-2		1.10	5,910	2,990	.479	28
Salmon-1		.90	5,390	3,230	.426	47
Salmon-2		.98	4,530	2,620	.434	18
Average		1.05	5,336	3,408	.444	20.4
Standard deviation		.27	597	968	.040	9.7

(con.)

Table AP-1 (Con.)

Specimen number	Compression wood[2] content	Modulus of elasticity	Maximum crushing strength	Proportional limit	Specific gravity[3]	Rings per inch[4]
		Million lb f/in²	*Lb f/in²*	*Lb f/in²*		
MONTANA						
Deerlodge-1		1.50	6,150	3,500	0.438	27
Deerlodge-2		1.46	6,890	4,160	.492	35
Flathead-1		1.37	6,460	4,550	.494	25
Flathead-2		1.42	5,910	4,530	.451	22
Gallatin-1		1.57	7,900	6,080	.485	37
Gallatin-2		1.80	8,700	5,220	.534	40
Helena-1		1.35	5,990	4,590	.487	42
Helena-2		1.86	7,240	5,300	.479	32
Kootenai-1		1.87	7,190	5,760	.499	29
Kootenai-2		2.09	8,730	5,590	.559	30
Average		1.63	7,116	4,928	.492	31.9
Standard deviation		.26	1,048	798	.035	6.5
OREGON						
Fremont-1	slight	0.84	5,410	2,830	0.520	33
Fremont-2	slight	.74	4,390	2,290	.445	34
Malheur-1		1.46	6,650	3,590	.452	19
Malheur-2		1.02	5,070	3,570	.460	26
Mount Hood-1	much	.80	5,080	1,860	.570	32
Mount Hood-2	much	.71	5,180	1,060	.590	26
Average		.93	5,297	2,533	.506	28.3
Standard deviation		.28	745	996	.063	5.8
UTAH						
Ashley-1		1.06	5,060	2,810	0.410	46
Ashley-2		.97	5,190	3,950	.415	24
Average		1.02	5,125	3,380	.413	35.0
Standard deviation		.06	92	806	.004	15.6
WASHINGTON						
Colville-1		0.96	4,280	3,110	0.389	10
Colville-2		1.33	5,350	4,110	.412	13
Okanogan-1		1.47	6,200	3,510	.465	48
Okanogan-2		1.71	7,030	5,270	.512	28
Wenatchee-1		1.27	6,050	4.500	.422	34
Wenatchee-2	slight	1.14	5,480	3,740	.460	20
State Forest-1		.95	5,130	3,620	.430	19
State Forest-2		1.08	5,220	3,890	.446	25
Average		1.24	5,593	3,969	.442	24.6
Standard deviation		.26	827	668	.038	12.2
WYOMING						
Bighorn-1		1.11	5,130	3,060	0.470	40
Bighorn-2		1.19	5,350	3,690	.463	42
Bridger-Teton-1		.88	4,940	2,890	.424	37
Bridger-Teton-2	slight	.78	4,510	2,720	.404	31
Medicine Bow-1		1.16	5,500	4,120	.472	32
Medicine Bow-2		1.42	6,230	4,520	.452	32
Shoshone-1		1.16	5,000	3,190	.467	42
Shoshone-2	slight	1.43	6,770	4,170	.472	28
Average		1.14	5,429	3,545	.453	35.5
Standard deviation		.23	738	672	.025	5.5

---

[1] Mechanical properties tabulated adjusted to a specimen moisture content of 10 percent of ovendry weight.

[2] See figure AP-1 for definition of terms.

[3] Specific gravity based on volume at test (8.2 percent moisture content) and ovendry weight.

[4] Average for the test specimen.

Table AP-2—Test-specimen characteristics tabulated by State averages and ranked by modulus of elasticity; standard deviations shown in parentheses

State	Number of specimens	Modulus of elasticity	Maximum crushing strength	Proportional limit	Specific gravity	Rings per inch
		Million lb f/in^2	*Lb f/in^2*	*Lb f/in^2*		
Montana	10	1.63	7,120	4,930	0.492	32
		(.26)	(1,048)	(798)	(.035)	(7)
Washington	8	1.24	5,590	3,970	.442	25
		(.26)	(827)	(668)	(.038)	(12)
Wyoming	8	1.14	5,430	3,550	.453	36
		(.23)	(738)	(672)	(.025)	(6)
Colorado	10	1.11	5,690	4,340	.466	56
		(.18)	(518)	(613)	(.022)	(36)
Idaho	12	1.05	5,340	3,410	.444	20
		(.27)	(592)	(968)	(.040)	(10)
Utah	2	1.02	5,130	3,380	.413	35
		(.60)	(92)	(806)	(.004)	(16)
Oregon[1]	6	.93	5,300	2,530	.506	28
		(.28)	(745)	(996)	(.063)	(6)

This lack of correlation with specific gravity is largely attributable to the presence of knot clusters in the specimens and, more importantly, to the sporadic presence of compression wood. Compression wood generally has high specific gravity, but—in dry wood—low mechanical properties. Also, trees that are fast growers may have more compression wood than the slow growers. For example, the two trees sampled from the Pinhead Butte area of the Mount Hood National Forest both had much compression wood and had average modulus of elasticity of only 760,000 lb f/in^2 with proportional limit of only 1,460 lb f/in^2 even though they had the highest specific gravity of any trees sampled (average 0.580); these two specimens had 32 and 26 rings per inch.

Differences in mechanical properties between specimens free of compression wood and those with compression wood readily visible in sanded cross sections are indicated in the following tabulation:

Property	No visible compression wood (42 specimens)	Visible compression wood (14 specimens)
	Lb f/in^2	
Modulus of elasticity		
Average	1,270,000	940,000
Standard deviation	299,000	250,000
Range	870,000-2,090,000	640,000-1,430,000
Maximum crushing strength		
Average	5,920	5,250
Standard deviation	986	722
Range	4,280-8,730	4,390-6,770
Proportional limit		
Average	4,130	3,030
Standard deviation	855	1,134
Range	2,620-6,080	1,060-5,110

Readers interested in a definitive treatise on compression wood will find useful Timell's (1986) three-volume work on the subject.

While data are far from adequate to characterize small lodgepole pines in the several States studied, particularly those of Utah where only two trees were sampled, a ranking of the States by specimens' average modulus of elasticity suggests that lodgepole pines in Montana's study areas have superior mechanical properties (table AP-2).

As an aid to material-balance computations for doweling plants, it is useful to note that for every pound of doweled $2^{1}/_{2}$-inch-diameter specimen produced, the shavings from the turning operation weighed 0.97 pound. Bulk density of the shavings (lightly packed, and at a moisture content of 8.2 percent of ovendry weight) was 9.6 pounds per cubic foot.

Table 9-1 indicates that the average inside bark diameter at stump height of the sample trees was 3.84 inches, and at the base of the crown it was 2.54 inches; height from stump top to crown base averaged 289.23 inches. A $2^{1}/_{4}$-inch-diameter dowel taken from the frustrum of a cone with these dimensions would represent 49.1 percent of the volume of the entire cone frustrum—a percentage nearly equal to the ratio of cross-sectional area of the dowel to the average cross-sectional area of these 56 sample stems at 20 percent of tree height (45.8 percent).

In brief, woody residues from doweling bark-free stems of this size should about equal the weight of $2^{1}/_{4}$-inch dowels produced.

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☆ U.S. GOVERNMENT PRINTING OFFICE:1988-573-039/81000

Koch, Peter; Barger, Roland L. 1988. Atlas of 28 selected commercial forest areas with unutilized stands of lodgepole pine. Gen. Tech. Rep. INT-246. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 171 p.

This atlas provides maps and general descriptions of a single representative problem area of more-or-less contiguous acreage within each of 28 public forests (National, Bureau of Land Management, and State) where increased utilization of lodgepole pine is desired by the forest manager. The 28 areas total 646,401 acres. Most of the lodgepole pine volume is of subsawlog size.

KEYWORDS: Colorado, forest policy, harvesting, Idaho, mechanical properties, Montana, Oregon, *Pinus contorta*, public forests, resource data, Sierra lodgepole pine, silviculture, stand replacement, stumpage value, tree dimensions, Utah, Washington, Wyoming

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A Data Structure for Describing Sampling Designs To Aid in Compilation of Stand Attributes

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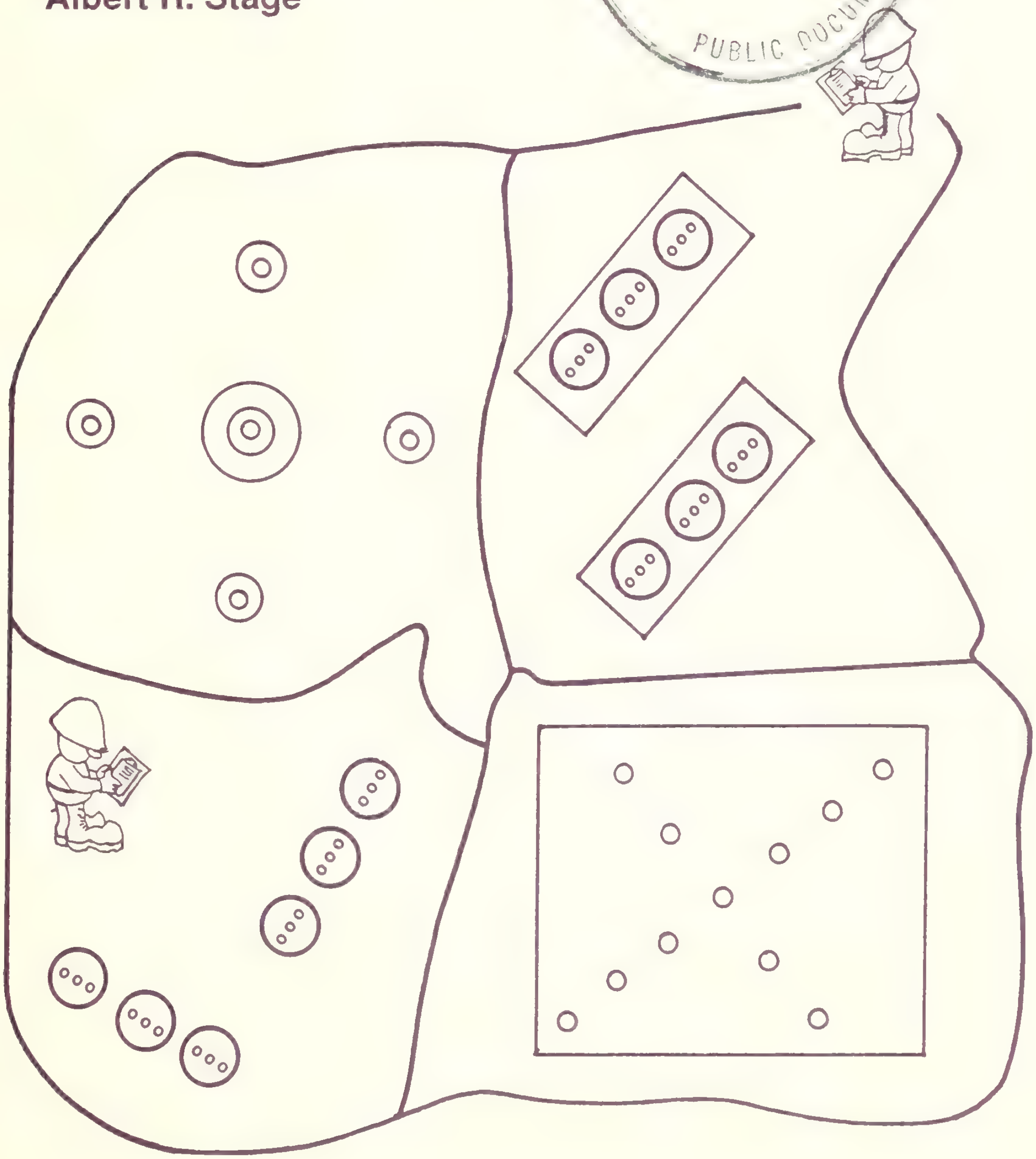

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RESEARCH SUMMARY

Maintaining permanent plot data with different sampling designs over long periods within an organization, and sharing such information between organizations, requires that common standards be used. Standards for measuring trees and describing stand conditions have been addressed, but procedures for describing underlying sampling designs within a stand have been ignored. We propose a data structure composed of just those variables and their relationships needed to compile stand attributes and their variances. Elements of this data structure include: (1) the spatial relationship of plots within the stand; (2) the definition of the subpopulations of trees sampled, the rules used to sample each subpopulation, and the linking variables that tie the subpopulation definitions and rules together; and (3) the accuracy with which the measurements on a sampled tree are taken. The data structure is able to incorporate changes in design that commonly occur through the life of a set of permanent plots. Using seven actual or proposed designs, from simple to complex, the data structure is compared to one of the better systems now available for managing permanent plot data. Whereas that system is inadequate in describing some of the more complex designs and any changes in design, the proposed data structure can fully describe all of the designs. We include applications of the data structure for designing of sampling schemes and for cataloging data.

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A Data Structure for Describing Sampling Designs To Aid in Compilation of Stand Attributes

John C. Byrne
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INTRODUCTION

Sharing of data on tree growth between organizations offers many opportunities for improving knowledge of forest yield capabilities. However, merging data from diverse sources requires that common definitions and standards be used. While standards for measuring trees and for describing stand conditions have received much attention (Curtis 1983; USDA Forest Service 1933), standardized procedures for describing variations in the underlying sampling designs within a stand have been ignored. As a consequence, opportunities for strengthening data bases or reducing costs have been forgone. Designs other than fixed-area plots have often been rejected as too inconvenient to process. Furthermore, the data needed for calculation of sampling variances have not been provided. Therefore, the weight to give to a particular stand in a merged analysis has not been available.

Differences in sampling design may be due to changing objectives and personnel within and between organizations, to changing forest conditions, or to innovation in sampling techniques. Designs are often made efficient for describing the stand at the time of installation. But at the time of remeasurement both organizational objectives and stand conditions will be different. So, a design that is appropriate at one stage of development may be inefficient for subsequent remeasurement. For example, large, fixed-area plots initially installed in stands close to rotation age have proven to be cumbersome when, through insects, disease, or regeneration treatments, the older stand is gradually replaced by regeneration. Some of these variations in sampling procedures in remeasured plot data may render the data worthless, while others complicate compilation of the data. Many of these problems could be avoided by appropriate modifications of the initial design.

We propose a data structure for describing designs that facilitates use of data from a wide variety of designs. This data structure consists of just those variables and their relationships needed to compile stand attributes and their variances. Our criterion is that any design that provides a valid basis for inference should be describable within this data structure. Conversely, mensurationists may be able to avoid some of the more troublesome pitfalls by considering how a proposed measurement procedure or a change in design would be represented in this data structure. This system is intended to apply to both routine inventory and silvicultural research data.

The data structure consists of variables that describe spatial relations, definition and sampling of subpopulations, and procedures for subsampling of tree attributes. This data structure does not define estimation techniques that might be used for statistical inference.

Compilation procedures based on the proposed data structure should be able to process data from a wider variety of designs than can be processed with present protocols. (An outline for such a procedure is available from the authors upon request. Write to Forestry Sciences Laboratory, Intermountain Research Station, Forest Service, U.S. Department of Agriculture, 1221 South Main St., Moscow, ID 83843.)

Finally, to illustrate our proposal, we apply it to seven existing or proposed designs.

EXISTING DATA STRUCTURES

The Weyerhaeuser Company and the Pacific Northwest Forest and Range Experiment Station undertook a notable effort to organize a common data base for Douglas-fir stand yield tables. The Western Forestry and Conservation Association sought to extend this initial effort and organized a committee (Committee on Standards of Measure and Data Sharing, COSMADS) to carry out the work. This committee set standards for permanent sample plots and cataloged the existing permanent plots in the Pacific Northwest (Arney and Curtis 1977; Western Forestry and Conservation Association 1977). At this time the COSMADS plot catalog is maintained by the British Columbia Forest Service.

In the early 1980's, Curtis and Clendenen (1981) began to coordinate a system of computer programs, initially written for the Douglas-fir stand yield work, for use in maintaining and accessing permanent-plot data bases. The Plot Data Management System (PDMS) is the outgrowth of that effort. In PDMS, one set of records describes plot attributes, including plot design. An associated set of records describes individual tree attributes, indexed by a plot identification variable.

Both PDMS and COSMADS were originally designed to deal with separate fixed-area plots only. Of the large number of permanent plots that we maintain at the Intermountain Research Station, only a small percentage can be classified as separate fixed-area plots. Many of the plots are variable-radius plots or have subsamples that are used to sample different parts of a population, or the plot design has changed over time. A recent update of PDMS describes variable-radius plots and two subsampling schemes (cluster layouts and concentric plots). And recently, COSMADS has added the capability of describing variable-radius plots.

ELEMENTS OF A DESIGN DESCRIPTION

The objective of this data structure is to facilitate creation of a data set in which each "record" represents an estimate of stand variables accompanied by treatment, site, and environmental attributes of the stand. The stand represented by the "record" is defined to be an area of ground with relatively uniform conditions that has received a unique treatment combination. Stand variables used for summarization include volume per acre, basal area per acre, increment in volume, change in top height, and so forth. Even if the data are to be used to represent growth relations for individual trees, stand variables are still required to define density or other variables influencing growth. When the stand is inventoried with multistage sampling within the stand, variances can be calculated to characterize internal variability of the stand and to estimate precision of the stand variables.

Designs are characterized by three elements. One, the spatial layout, determines how measurements taken at one place are related or are to be used with measurements taken nearby. The second element describes the emphasis given to sampling different members of the population. For example, the subpopulations of large trees or scarce species might be sampled on larger plots, while small trees or common species might be sampled on one or several smaller plots. The required information is the sampling probability associated with each tree in the list. The third element describes how tree characteristics are measured for each sampled tree. For example, were tree heights measured with a clinometer or were they estimated from a diameter at breast height-height regression?

The advent of geometric point and line sampling and of sampling with arbitrary probability has made conventional ways of describing sampling designs inadequate if not totally inappropriate. Whereas conventional specification of inventory design focused on description of "the plot" or "plots" as pieces of ground, the procedures we propose focus on description of subpopulations of trees and their spatial distribution.

The key change in thinking—and in describing the sampling design—is the change from defining the sampling unit as the "plot" drawn from a population of all possible plots in the area being sampled to defining the sampling unit as a group of trees, drawn from the population of all trees in the area being sampled. In this data structure, the role of the "plot," if used at all, is to define the clustering of the sample trees. In this perspective, we follow the concepts used by O'Regan and Palley (1965).

For fixed-area plots, either conceptual framework is adequate. However, with variable-probability sampling designs such as point sampling, plot-oriented definitions lead to such concepts as "ongrowth," "nongrowth," and their logical corollary, "offgrowth." These concepts have been used as though they are characteristics of the trees when in fact they are artifacts of the sampling design. They are unnecessary in the system we propose. Their role in compilation has been supplanted by the variables in the proposed data structure.

Spatial Relations

The concept of a "stand" as a uniquely treated, biologically uniform area is a key reference point in the hierarchy of spatial relations that extends from an individual tree upward to the complex mosaic of site and vegetation that comprise a forest. Levels of the spatial hierarchy within the "stand" then are used to describe the internal spatial variability of the stand. Internal variability, whether described by a stem map or by variation between plots, may be useful for purposes of explaining stand growth, for localizing effects on individual trees, and for calculating variances of stand variables. In research studies, the experimental unit would correspond to our "stand" and represents a single degree of freedom. Then, spatial relations between stands describe the patterns of replication and blocking that are usually thought of as describing an experimental design. Even though this paper will be concerned only with levels of spatial hierarchy within the "stand," we recognize that an installation numbering system is required to describe the relations between stands in an experimental design or to identify stands to an administrative unit in an inventory.

Sampling Subpopulations

Contribution to stand totals from various subpopulations is an important stand attribute. Subpopulations of particular interest are often defined by diameter, species, or age class.

Varying Emphasis—When some subpopulations are more interesting than others, sampling procedures may be optimized by varying the sampling probabilities among the subpopulations. The distribution of sampling probabilities is controlled by two factors of the design: the number of sampling points within the stand and the rules that determine which trees are measured at each point. If the stand and plot are synonymous (except for the necessary buffer strips) and all trees within the plot are tallied, then all sampling probabilities are equal to unity. However, if the stand is too large for complete enumeration, it may be sampled at a number of points at which trees are included with constant probability as with fixed-area plots, or with probability proportional to basal area as with variable-radii plots, or proportional to arbitrary attributes of the trees as in 3-P sampling (Grosenbaugh 1958).

When inclusion of a tree in the sample is defined by the geometrical relations between tree location and its dimensions—as it is with geometrical point and line samples using d.b.h. or height in comparison to an angle gauge—then sampling probabilities are defined implicitly for all trees by the geometry of the angle gauge (Grosenbaugh 1958). However, for sampling with arbitrary probabilities, the sampling probability is required for every tree in the population (Grosenbaugh 1963).

Finally, the sampling probabilities for a tree in the tally at a sample point may be a function of both tree and plot geometry and of categorical attributes of the tree such as species, whether live or dead, or sound or cull.

Implications for Estimating Components of Growth—Growth analysis often requires compilation of change in the **population** between two examinations, composed of ingrowth, accretion, and mortality (Gilbert 1954). Procedures for estimating change between remeasurements of permanent plots have been a long-standing area of confusion. Most of the confusion surrounding growth calculations for variable-sized plots arises from: (1) the possibility of estimating the accretion component based on either the starting or ending sampling probabilities; and (2) the attempt to constrain sample-based estimates to have the same relations between growth components as would be obtained from complete enumeration of a finite population (Martin 1982). When changes in design are considered, the confusion is even worse (Chapman 1985). Each component depends on the period to which it applies and on the population (or subpopulation) to which it applies.

Of the three components, ingrowth is unique in that estimates can be based only on the end-of-period sampling probabilities. Accretion and mortality can be estimated using either start-of-period sampling probabilities or end-of-period probabilities. Indeed, the equality of sampling probabilities from period to period is one of the attractions of fixed-area plots for which sampling probabilities are constant.

Subsampling Tree Characteristics

This third element of design describes the rules that specify the measurements to be taken on a particular sampled tree. We had two alternatives. In one, the data structure might specify how an attribute is to be estimated from the subsample. For example, one could specify a regression estimator with its coefficients, or specify a probability-based estimator with its attendant subsampling probabilities.

The other alternative, which we chose, is simply to enter values for each tree, however estimated, for each attribute along with an indicator of the attribute's reliability. This indicator, besides noting whether trees were directly measured or estimated, can also describe the general accuracy associated with each directly measured attribute. The accuracy will influence the trust one has in the stand attributes calculated using those measurements. For example, whether heights were measured using a clinometer with ±1-foot accuracy or using ocular estimation with ±10-foot accuracy would have an impact on the inferences made from stand attributes based on heights. Also, rules could be established to relate measurements taken with less accuracy to ones with more accuracy from the same stand. If crown ratios were measured directly on some trees with a clinometer and ocularly estimated on the rest of the trees, a rule could be derived to adjust the ocular estimates based on the more accurately measured crown ratios.

PROPOSED DATA STRUCTURE FOR DESCRIBING SAMPLING DESIGNS

In this section, we will define the pertinent variables that are necessary in detailing each of the three design elements.

Spatial Relations

The first design element, the spatial relationship of the plots in a stand, is described by the numbering scheme of the plots. The important consideration in recording spatial relations is describing the proximity of plots used to sample the various subpopulations. When one plot is nested within another (a subplot), covariance between stand attributes for the subpopulations must be included in the overall variance estimate of the stand when computing variance of the estimates for the total population. For variance calculations, and for finding numbered trees during remeasurement, it is essential to know which samples are within related samples used to describe another subpopulation.

The plot numbering scheme also serves a vital role in data management. The fundamental unit in the numbering scheme within the stand is the "plot," which is defined as the collection of trees included within a single sampling unit. Each plot is given a number that must be a part of the unique identifier for each individual tree record such that the tree records always can be associated with records describing the plot. When sampling units are nested, subordinate levels of numbering are needed: subplots, sub-subplots, and so forth. Our work with a variety of complex designs suggests that one level subordinate to plot (subplot) is sufficient for most designs. With more complex plot designs, additional levels of subordination could use columns of the subplot field. All sampling units within a nest have the same plot number but different subplot numbers. Subplot number 0 is assigned to the sample that is not internal to any other plot. Once plot and subplot numbers are created, they must never change. Several sampling designs that are described in a later section of this paper include the numbering scheme.

Using the numbering scheme to describe spatial relations only indicates plots within other plots, which is sufficient for most purposes. If it is necessary to know more about the proximity of plots, more information would be needed. Indicating coordinates (x, y) for each plot within a stand would provide a means for determining the distance to other plots such that spatial autocorrelations could be represented.

Providing a unique tree identification is an important part of the structure. Each tree is uniquely identified by its plot/subplot/tree number. In repeated sampling of the same stand, trees will often grow from one subpopulation into another. Proper compilations of per-acre values require that a tree growing into a different subpopulation be treated as a new individual in that subpopulation, although identified by its original plot/subplot/tree numbers. A tree can never occur in two or more subpopulations at the same time and can only occur once in each subpopulation.

The type of sampling design may have implications on the tree numbering. When sampling is done without replacement, no one tree will occur in more than one sample. But when sampling is done with replacement, as with a cluster of variable-radius plots in a stand, a tree may be included in more than one plot. Points too closely clustered, or a basal area factor (BAF) that is too small, will increase the likelihood of this undesirable situation happening. However, when a tree does occur in two samples as described above, the tree should be treated as two trees with different numbers.

The variables used to describe spatial relations are:

Plot number = An integer number P_i that identifies a cluster of sample trees; $i = 1,\ldots n$ where n is the total number of plots in the stand.

Subplot number = An integer number S_j that identifies a cluster of sample trees that is nested within plot P_i; $j = 0,1,\ldots m_i$ where m_i is the total number of subplots within plot P_i. Subplot number 0 indicates a set of trees that is within plot P_i and not within any subplot.

Sampling Subpopulations

The totality of trees to be included in stand statistics may be divided into subpopulations. The division may be motivated by the intrinsic interest in the subpopulation or by considerations of sampling efficiency. In the data structure we are specifying, each subpopulation must be mutually exclusive and, in the aggregate, encompass the whole population. Furthermore, each subpopulation is to be sampled with one or more simple sampling rules. By simple, we mean that the sampling procedure can be described by the number of samples and the rule that establishes the sampling probability for each individual tree (that is, plot area for fixed-area plots, BAF for variable-radii plots, and so forth). Subpopulations sampled with more than one sampling rule also require that each tree be identified with the rule that brought it into the sample. Because the defined subpopulations are associated with particular sampling rules, the definition must be based on attributes as they exist at the time of sampling.

In defining each subpopulation one must record the tree characteristics used in delimiting the subpopulation. The most common way of defining tree subpopulations in permanent sample plot work has been by diameter at breast height (d.b.h.) limits. For vertical point sampling schemes, height is the delimiting variable. In some studies the presence or absence of a certain tree characteristic—for example, presence of a particular disease organism or whether the tree is alive or dead—may define the subpopulations. Once the delimiting variable is recorded, the delimiting values of the variable must be entered. For d.b.h. or height limits, the delimiters are the minimum and maximum level. For discrete attributes, codes for the specific characteristics are used in the subpopulation definitions. Though in most cases only one variable is used as a delimiter, the system should be capable of recording several delimiting variables and their appropriate values. An example of using more than one variable to define a subpopulation would be when a "plot" is used to measure both live and dead trees greater than 9.5 inches d.b.h., instead of the assumed case of only live trees greater than 9.5 inches. Usually, tree death is recorded and then measurement is stopped on the tree, but in this example, continuous measurement of dead trees is necessary for quantifying possible wildlife habitat. Both d.b.h. and a tree code (for live and dead) would be necessary to define the subpopulation.

The variables used to define subpopulations are:

Subpopulation number = An integer number K that identifies a subpopulation of trees in a stand; $K=1,\ldots p$, where p is the total number of subpopulations that make up the population of trees in the stand.

Variable for delimiting a subpopulation = A tree characteristic used in delimiting the trees that belong in subpopulation *K*. Designated as *V*, *V*=1,... *t*, where *t* is the total number of variables used in delimiting subpopulation *K*. The tree characteristic can be either continuous (d.b.h., height, and so forth) or discrete (tree class code, tree condition code, species code, and so forth) variables. Possible codes for commonly used variables are:

D = d.b.h. limits
H = height limits
T = tree class codes (alive, dead, and so on)
C = tree condition codes (insect and disease damage and so on)
S = species codes.

Minimum value or first code for variable *V* = A delimiting value for variable *V*, used in defining subpopulation *K*. For continuous variables, the minimum value (that is, a minimum d.b.h. limit) and for discrete variables an inclusive value (a specific code, such as tree class codes where 0 = live trees and 2 = dead trees).

Maximum value or second code for variable *V* = A delimiting value for variable *V*, used in defining subpopulation *K*. For continuous variables, the maximum value and for discrete variables, an additional inclusive value (if necessary).

The type of sampling rule used to select the trees in each subpopulation defines the probability with which a tree is sampled. For fixed-area samples (whether plots or strips), the probability of a tree being sampled depends only on its presence or absence. All trees in the defined area that meet the subpopulation definitions are measured, so the sampling probability is constant. With geometric point and line sampling, tree size characteristics are used to define the probability of tree selection. With horizontal point sampling (that is, variable-radius plots), basal area is used as the tree characteristic, while with horizontal line sampling, tree d.b.h. is used. With vertical point and line sampling, height is used as the tree size characteristic for determining whether a certain tree should be included in a sample. See Grosenbaugh (1958) and Oderwald (1981) for a more detailed explanation of the various point and line sampling schemes.

Corresponding to each sampling scheme is an expansion constant used in converting the counts tallied to per-acre stand attributes. For a fixed-area plot, the expansion constant is the reciprocal of plot area. Multiplying the number of trees counted on a plot by this expansion constant results in trees per acre. For horizontal point samples, the expansion constant is BAF. To calculate trees per acre for horizontal point samples, BAF is used to calculate a conversion factor for each tree d.b.h., that is, BAF/(BA for the tree). Then this conversion factor is multiplied by the number of trees counted with that d.b.h. and summed for all d.b.h. classes to get trees per acre. Likewise, for the other point and line sampling schemes, there are appropriate expansion constants (Grosenbaugh 1958).

When the sampling probabilities cannot be calculated from plot and tree factors, as in 3-P or other arbitrary sampling probability schemes, then an explicit variable defining the sampling probability must be provided for each tree.

The variables used to describe sampling rules are:

Sampling rule number = An integer number R that identifies the set of variables (that is, variable for defining sampling probability, expansion factor, and number of samples) that form a sampling rule; $R = 1, \ldots q$ where q is the total number of sampling rules used through the life of the sampling design.

Variable for defining sampling probability = The tree characteristic used in determining the probability of a tree being sampled. Possible codes for commonly used variables are:

CON = constant, for fixed-area plots or strip plots
BA = basal area, for a horizontal point sample
DBH = diameter at breast height, for horizontal line sample
HTS = square of height, for a vertical point sample
HT = height, for a vertical line sample
ARB = subjective definition of sampling probabilities (3-P).

Expansion constant = The inverse of the sampling probability used in converting counts tallied to a per-unit area basis. The expansion constants for the variables listed above are:

For CON, expansion constant = 1/plot area or 1/strip area
For BA, expansion constant = BAF
For DBH, expansion constant = horizontal line factor (HLF)/line length
For HTS, expansion constant = vertical point factor (VPF)
For HT, expansion constant = vertical line factor (VLF)/line length
For ARB, sum of variable proportional to probabilities.

Number of samples = Total number of samples used with sampling rule R.

Knowing the stand area is often important in designs where the stand area is represented only by a sample. The relation between sampled area and stand area allows the finite population correction factor to be included in the sampling error. Although traditional experimental studies have a 100 percent sample of the population in each stand area except for a buffer strip, in operational studies, a 100 percent sample of such a population is impractical.

Subsampling Tree Characteristics

Associated with each tree characteristic measurement in the tree records, there should be a field that designates whether or not that characteristic was directly observed, and if directly observed the accuracy of that measurement. This could easily be done with a simple set of codes for each tree characteristic. Possible codes for each of three commonly measured tree characteristics are listed below.

D.b.h.

0 = not directly observed
2 = ±0.1 inch (D-tape or caliper)
5 = ±1 inch (Biltmore stick)
7 = ±2 inches (ocular estimate to 2-inch d.b.h. class)

Height

0 = not directly observed
2 = ±0.1 foot (dendrometer)
4 = ±0.5 foot (telescoping height pole)
6 = ±1 foot (clinometer, Abney level, Haga altimeter)
9 = ±10 feet (ocular estimation)

Crown ratio

0 = not directly observed
2 = ±1 percent (measured heights with clinometer, and so forth)
6 = ±5 percent (ocular estimate)

Codes for other measurement accuracies could easily be added for any of the tree characteristics.

LINKING SUBPOPULATIONS TO SAMPLING RULES

To completely specify compilation procedures to be used for a particular examination date, it is necessary to link the subpopulation being sampled, the sample rule used, and the date when sampling began to each plot/subplot identifier. The date indicates when changes in plot design, such as how a subpopulation is sampled, have occurred so that analysis procedures can be changed accordingly. Each plot and subplot description includes the total design description of which it is a part. Then, a field in the plot and subplot description references the specific subpopulation that is sampled, the sampling rule, and the date the design was initiated for this plot and subplot. Whenever design changes are made, a new set of these linking variables must be added to the description in order to facilitate compilation procedures. These linking variables are:

Subpopulation sampled = Subpopulation number K sampled at plot P_i and subplot S_j.

Sampling rule = The sampling rule R used to sample subpopulation K at plot P_i and subplot S_j.

Date design initiated = The calendar year in which subpopulation K was initially sampled with sampling rule R at plot P_i and subplot S_j.

DESIGN CHANGES AND THEIR IMPLICATIONS

Design changes can be the result of changes in subpopulation definitions or of changes in the sampling rule applicable to a subpopulation. When subpopulation definitions or sampling rules or both change, new plot and subplot identifiers may be needed. These identifiers must be added to each tree record.

Because trees can “move” from one subpopulation to another in successive periods, it is possible for a tree to “leave the sample.” However, to calculate accretion, it is necessary to record the tree attributes at subsequent examinations even though the tree would not be included by the rules in effect at that later period. Trees “leaving the sample” because of design changes that create an additional level of subplots are assigned a zero subplot number at that level to indicate that they are no longer included by the current sampling rules. Designs that permit trees to leave the sample should be diligently avoided. However, the procedures we have described would permit valid compilations, although the field work and the compilation program are rendered more cumbersome.

The following example is used to describe how to handle design changes. The design (design 3 in the examples) has one subpopulation that existed from 1933 through 1974. All trees ≥1.0 inches d.b.h. were sampled on a square 0.25-acre plot. During this time all trees were in plot 26, subplot 0. Due to a change in the composition of the stand from one of larger trees to one with a thick stand of smaller trees, the sampling scheme for smaller trees was changed at the 1984 remeasurement. Two new subpopulations were created. Subpopulation 2, consisting of trees ≥3 inches d.b.h., is sampled with the entire 0.25-acre plot. Subpopulation 3, consisting of trees 1.0 to 3 inches d.b.h., is sampled with 11 plots of $^1/_{300}$ acre each within the original 0.25-acre plot. Now the numbering scheme changes to plot 26, subplot 0 (≥3 inches d.b.h.) and plot 26, subplots 1 to 11 (1.0- to 3-inch d.b.h.). From 1984 on, plot 26, subplot 0 is used to sample subpopulation 2 (this is indicated with the linking variables previously described). All trees in subplot 0 before 1984 remain in subplot 0 after 1984 except for those 1.0- to 3-inch trees that are within one of the 11 plots of $^1/_{300}$ acre each. Those trees have their subplot numbers changed to indicate in which subplot they now reside. Those trees that are 1.0- to 3-inch d.b.h., were tallied previous to 1984, and were not in one of the $^1/_{300}$-acre plots in 1984 are retained in subplot 0 for calculation of accretion. But if stand attributes were compiled in 1984, these trees would not be used in the compilations. Only when they reach a size ≥3 inches will they be included in stand calculations again.

ILLUSTRATION OF THE PROPOSED DATA STRUCTURE

Seven sampling designs will be used to demonstrate the capabilities of the proposed data structure. Designs 2, 3, 4, and 7 are actual or proposed designs in use at the Intermountain Research Station. Design 1 is used in a research project at the University of Montana (Sweet 1987) and was provided through cooperative work in compiling a permanent plot data base for the Inland Northwest Growth and Yield Cooperative (INGY). Design 5 is the Managed Stand Survey in the Pacific Northwest Region of the National Forest Systems (USDA Forest Service 1986b). Design 6 is used by the Northern Region of the Forest Service for its growth-monitoring plots (USDA Forest Service 1986a)

These seven designs illustrate a progression from simple to complex. Design 1 is a simple fixed-area plot. Design 2 illustrates a change in the population sampled on a fixed-area plot, while design 3 shows a change in the sampling rule for part of the population. Design 4 documents the sampling of a stand (that is, clustering), with one level of subsampling within each plot in the stand, while design 5 shows additional complexity in a stand subsampling design. Design 6 illustrates multiple subsamples within each plot of a cluster design, and design 7 illustrates larger plots added to design 6 after its establishment.

The description of each sampling design consists of several parts. First is a narrative description, along with a sketch of the design (sketches are not included for the simpler designs). The symbols used in the sketches are shown in figure 1. Next, the design is described using the proposed data structure. Finally, the numbering scheme for the plots and subplots within the design is shown. A linking variable is included with the numbering. This linking variable is not part of the unique identifier for each sample (as plot and subplot are), but instead links the numbering scheme to the sampling design description (example: 2-1-1984 means subpopulation 2 is sampled using sampling rule 1 beginning in 1984).

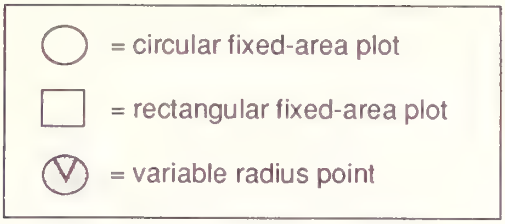


Figure 1—Symbols used in design sketches.

DESIGN 1

A study with an experimental design of two blocks with four treatments within each block and two replications of each treatment per block. Each treated plot of the same size, a square 0.2-acre plot. All trees ≥0.5 inch d.b.h. are measured within a plot. (Swan Valley Ponderosa Pine Study.) In the descriptions, only the description for one plot is given. Because each plot consists of a distinct treatment, each plot is treated individually.

Description using proposed data structure:

Subpopulation number	1
1st var. for subpop. definition	D
Minimum or 1st code	0.5
Maximum or 2nd code	99.9
2nd var. for subpop. definition	
Minimum or 1st code	
Maximum or 2nd code	

Sampling rule number	1
Variable defining probability	CON
Expansion constant	5
Number of samples	1

Numbering scheme:	Plot #	Subplot #	Linking variable
	1	0	1-1-1984

DESIGN 2

A 2.0-acre square plot where the diameter limit of trees measured changes after one measurement. In 1922, all trees ≥3.6 inches d.b.h. were measured on the plot, but in measurements from 1927 to 1952 all trees ≥0.6 inch d.b.h. were measured on the plot. (Plot 1 of the Intermountain Research Station Permanent Sample Plot Collection.)

Description using proposed data structure:

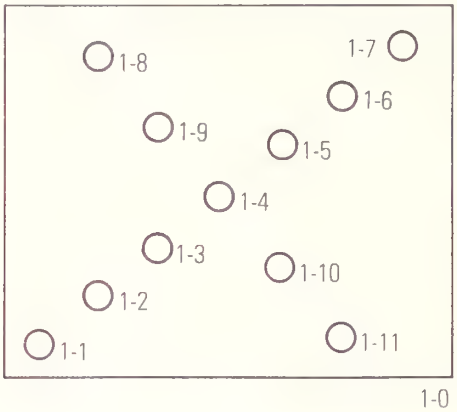
Subpopulation number	1	2
1st var. for subpop. definition	D	D
Minimum or 1st code	3.6	0.6
Maximum or 2nd code	99.9	99.9
2nd var. for subpop. definition		
Minimum or 1st code		
Maximum or 2nd code		

Sampling rule number	1
Variable defining probability	CON
Expansion constant	2
Number of samples	1

Numbering scheme:	Plot #	Subplot #	Linking variable
	1	0	1-1-1922, 2-1-1927

DESIGN 3

A 0.25-acre square plot in which the sampling of the smaller tree population has changed after the plot has been established for many years. From 1933 to 1974, all trees ≥1.0 inches d.b.h. were measured on the plot. Due to a change in the composition of the stand from one of larger trees to one with a thick stand of smaller trees, the sampling scheme for smaller trees was changed at the 1984 measurement. All trees ≥3.0 inches d.b.h. were measured on the plot, but trees 1.0 to 2.9 inches d.b.h. were subsampled using 11 plots of $^{1}/_{300}$ acre each, distributed systematically within the larger 0.25-acre plot. All trees 1.0 to 2.9 inches d.b.h. were measured and tagged on these $^{1}/_{300}$-acre plots. See drawing below. (Plots 26, 28, 148, 157, 160 in Intermountain Research Station Permanent Sample Plot Collection.)



Description using proposed data structure:

Subpopulation number	1	2	3
1st var. for subpop. definition	D	D	D
Minimum or 1st code	1.0	3.0	1.0
Maximum or 2nd code	99.9	99.9	2.9
2nd var. for subpop. definition			
Minimum or 1st code			
Maximum or 2nd code			

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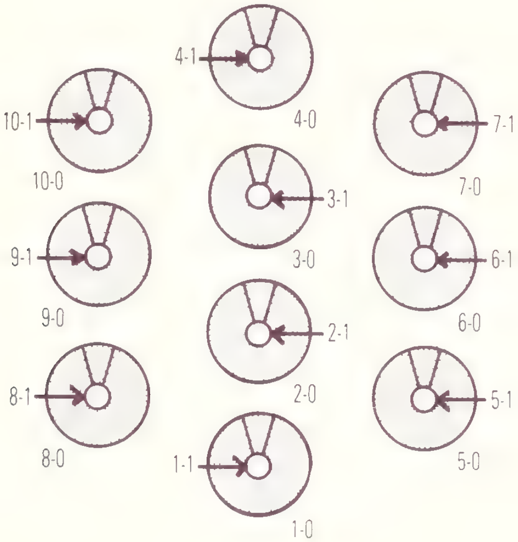
Sampling rule number	1	2
Variable defining probability	CON	CON
Expansion constant	4	300
Number of samples	1	11

Numbering scheme:	**Plot #**	**Subplot #**	**Linking variable**
	1	0	1-1-1933, 2-1-1984 ($^{1}/_{4}$-acre plot)
	1	1	3-2-1984($^{1}/_{300}$-acre plot)
	1	2	3-2-1984
	1	3	3-2-1984
	1	4	3-2-1984
	1	5	3-2-1984
	1	6	3-2-1984
	1	7	3-2-1984
	1	8	3-2-1984
	1	9	3-2-1984
	1	10	3-2-1984
	1	11	3-2-1984

DESIGN 4

A cluster of 10 BAF 20 variable radius plots, each with a 1/300-acre subplot for measurement of regeneration, scattered through a similarly treated area. Variable radius plots used to measure trees ≥5.0 inches d.b.h. and 1/300-acre plot used to measure trees from seedlings to 4.9 inches d.b.h. There are 35 stands in this study. Drawing of one stand is shown below. (USDA Forest Service Region 1 Birgenheier Study and older Forest Survey Standard Design.)



Description using proposed data structure:

Subpopulation number	1	2
1st var. for subpop. definition	D	D
Minimum or 1st code	5.0	0.0
Maximum or 2nd code	99.9	4.9
2nd var. for subpop. definition		
Minimum or 1st code		
Maximum or 2nd code		

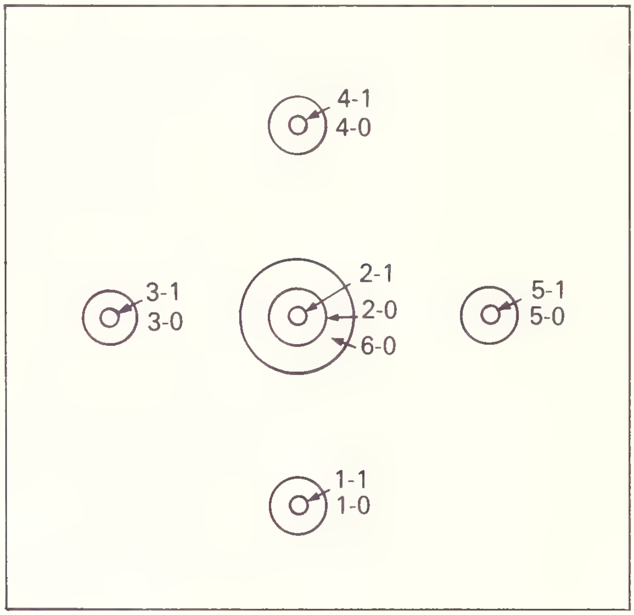
- -

Sampling rule number	1	2
Variable defining probability	BA	CON
Expansion constant	20	300
Number of samples	10	10

Numbering scheme:	Plot#	Subplot#	Linking Variable
	1	0	1-1-1970 (var. radius plot)
	1	1	2-2-1970 (1/300-acre plot)
	2	0	1-1-1970
	2	1	2-2-1970
	.	.	.
	.	.	.
	.	.	.
	10	0	1-1-1970
	10	1	2-2-1970

DESIGN 5

A cluster of five concentric plots is located within a similarly treated area. Each of the concentric plots consists of two plots: a $^{1}/_{100}$-acre plot for counts of live seedlings and trees <1.0 inch d.b.h., and a $^{1}/_{20}$-acre plot for measurement of live trees ≥1.0 inch d.b.h. Dead trees are measured as an indicator of wildlife habitat. There is an additional area around the second $^{1}/_{20}$-acre plot to record additional live trees with the size of ≥9.0 inches d.b.h. Fewer characteristics are measured on the trees in this area than on those similarly sized trees in the $^{1}/_{20}$-acre plot. The area of this plot is $^{3}/_{20}$ acre, the "donut-shaped" area between a $^{1}/_{5}$-acre and a $^{1}/_{20}$-acre circular plot. The drawing shows one stand. Many such stands in the study. (USDA Forest Service Region 6 Managed Stand Survey.)



Description using proposed data structure:

Subpopulation number	1	2	3	4
1st var. for subpop. definition	D	D	D	D
Minimum or 1st code	9.0	9.0	1.0	0.0
Maximum or 2nd code	99.9	99.9	8.9	0.9
2nd var. for subpop. definition		T	T	
Minimum or 1st code		2	0	
Maximum or 2nd code			2	

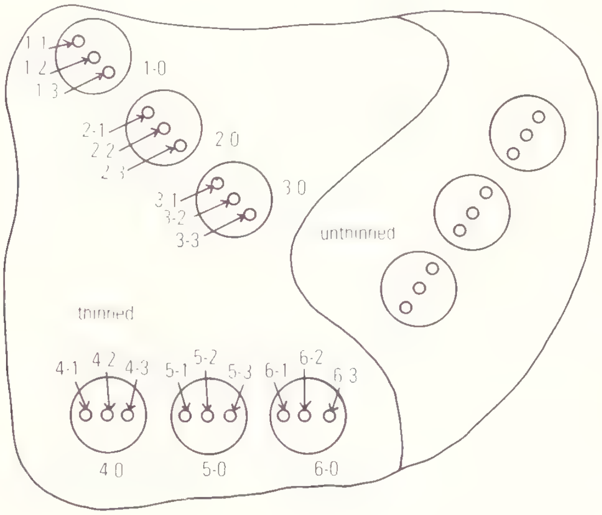
- -

Sampling rule number	1	2	3
Variable defining probability	CON	CON	CON
Expansion constant	20	6.667	100
Number of samples	5	1	5

Numbering scheme:	**Plot #**	**Subplot#**	**Linking variable**
	1	0	1-1-1987,2-1-1987,3-1-1987 ($^1/_{20}$-acre)
	1	1	4-3-1987($^1/_{100}$-acre)
	2	0	1-1-1987,2-1-1987,3-1-1987
	2	1	4-3-1987
	.	.	.
	.	.	.
	.	.	.
	5	0	1-1-1987,2-1-1987,3-1-1987
	5	1	4-3-1987
	6	0	1-2-1987 ($^3/_{20}$-acre)

DESIGN 6

An installation with two treatments, one thinned, the other a control. Each area has the following basic design: a strip of three $^1/_{20}$-acre plots, located randomly in the area. Within each $^1/_{20}$-acre plot there is a subsample of three $^1/_{300}$-acre plots for measurement of trees from seedlings to 2.9 inches d.b.h. The $^1/_{20}$-acre plot is used to measure trees ≥3.0 inches d.b.h. The thinned area has two such strips (six $^1/_{20}$-acre plots) and the control has one strip (three $^1/_{20}$-acre plots). See drawing below. Only the thinned stand for one installation is described below. Many installations of this sort in the study. (USDA Forest Service Region 1 Monitoring Plots.)



Description using proposed data structure:

Subpopulation number	1	2
1st var. for subpop. definition	D	D
Minimum or 1st code	3.0	0.0
Maximum or 2nd code	99.9	2.9
2nd var. for subpop. definition		
Minimum or 1st code		
Maximum or 2nd code		

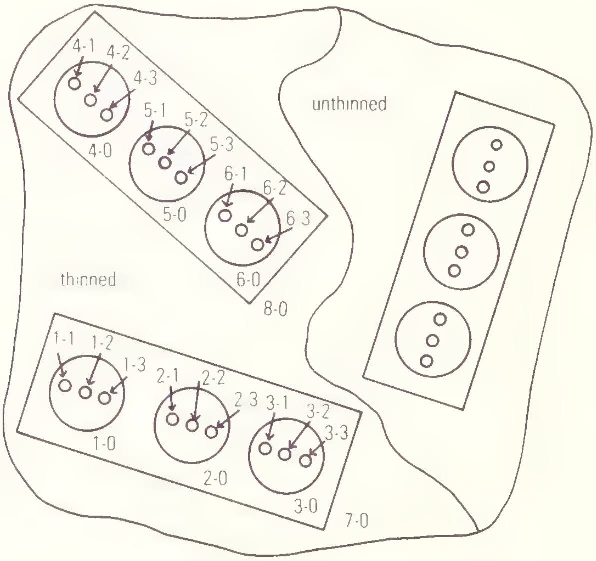
Sampling rule number	1	2
Variable defining probability	CON	CON
Expansion constant	20	300
Number of samples	6	18

Numbering scheme:

Plot #	Subplot #	Linking variable
1	0	1-1-1984 (${}^{1}/_{20}$-acre plot)
1	1	2-2-1984 (${}^{1}/_{300}$-acre plot)
1	2	2-2-1984 (${}^{1}/_{300}$-acre plot)
1	3	2-2-1984 (${}^{1}/_{300}$-acre plot)
2	0	1-1-1984
2	1	2-2-1984
2	2	2-2-1984
2	3	2-2-1984
.	.	.
.	.	.
.	.	.
6	0	1-1-1984
6	1	2-2-1984
6	2	2-2-1984
6	3	2-2-1984

DESIGN 7

A larger plot is laid out around each set of three plots described in design 6. This additional plot is established at the time of the second measurement. This plot, with area of ${}^{17}/_{20}$ acre (1.0 acre minus ${}^{3}/_{20}$ acre), samples only trees that have died since the last measurement. Once a tree is recorded as dead, it is painted so that it will not be sampled again. See drawing below. Only the thinned stand is described below. (Proposed mortality overlay on USDA Forest Service Region 1 Monitoring Plots.)



Description using proposed data structure:

Subpopulation number	1	2	3
1st var. for subpop. definition	D	D	T
Minimum or 1st code	3.0	0.0	2
Maximum or 2nd code	99.9	2.9	
2nd var. for subpop. definition			
Minimum or 1st code			
Maximum or 2nd code			

- -

Sampling rule number	1	2	3
Variable defining probability	CON	CON	CON
Expansion constant	20	300	1.176
Number of samples	6	18	2

Numbering scheme:	Plot#	Subplot #	Linking variable
	1	0	1-1-1984 (1/20-acre plot)
	1	1	2-2-1984 (1/300-acre plot)
	1	2	2-2-1984 (1/300-acre plot)
	1	3	2-2-1984 (1/300-acre plot)
	.	.	.
	.	.	.
	.	.	.
	6	0	1-1-1984
	6	1	2-2-1984
	6	2	2-2-1984
	6	3	2-2-1984
	7	0	3-3-1988 (17/20-acre plot)
	8	0	3-3-1988 (17/20-acre plot)

The proposed data structure is general enough to effectively describe all of the example designs. It should be flexible enough to also work with most other sampling designs. The Plot Data Management System (PDMS) was able to adequately describe only designs 1 and 4. Application of PDMS to the other designs was limited by the inability to describe changes in plot design, subsamples other than concentric designs, population definitions other than diameter limits, and designs that have differing numbers of plots of different sizes. When designs cannot be described adequately within a data structure, one would have to rely on comment fields to explain the missing facts about the design. This is inefficient and precludes preparation of analysis programs that can use the design information to compile stand statistics.

APPLICATIONS

Applications of this system could be in the field or in cataloging of data.

Sampling Design and Field Procedures

Although this data structure can be used to describe complex designs, this power should be used sparingly. Simplicity of design and field procedures should be paramount. These suggestions should be followed:

1. Numbers of subpopulations associated with different sampling rules should be kept small, again, to keep field procedures simple and easy to remember. The situation in design 5 illustrates this point. Trees ≥ 9.0 inches d.b.h. are sampled with five 1/20-acre plots and also by one donut-shaped 3/20-acre plot that is concentric with one of the 1/20-acre plots. This extra plot unduly complicates the design if its sole purpose is to obtain additional growth sample trees. If additional sample trees are needed, it might be simpler to increase the size of the present 1/20-acre plots, thus eliminating the need for the extra odd-shaped plot.

2. For cluster-sampling, spacing between plots should be considered in relation to plot size to avoid having the same tree in more than one plot. A cluster of 10 BAF 10 points, with plot centers 50 feet apart, in a stand with average d.b.h. of 10 inches, would result in many trees occurring in more than one plot.

3. Sampling rules and subpopulations should be so related that ingrowth is not sampled with geometric variable probability rules. Ingrowth should enter the sample through a constant probability sample (a fixed-area plot). Otherwise, the size of the ingrowth trees would have to be determined as of the previous measurement to establish whether the tree is actually ingrowth or an additional tree in the new sample. Remeasurement intervals should be related to growth rates such that ingrowth will only be possible into the subpopulation containing the smallest trees. For example, if a BAF 20 point is used as a permanent plot, a 1/300-acre plot, concentric with the point center, should be used to

measure ingrowth 1 to 3.5 inches d.b.h., and the BAF 20 point be used to sample trees ≥3.5 inches d.b.h. Remeasurement intervals of 10 years or less in most regions would be adequate because a tree is not likely to grow more than 2.5 inches d.b.h. (or, 3.5 minus 1.0 inches) in that period.

4. The possibility of a tree "leaving the sample" previously mentioned would imply that a previously tagged tree should not be remeasured at some examinations, unless it might be ingrowth into a subpopulation of particular interest. Hence, the relations between the design variables for each subpopulation should be considered with regard to their effect on the field examination procedures. If the d.b.h. range for the $^1/_{300}$-acre plot mentioned in item 3 above were 1 to 3 inches instead of 1 to 3.5 inches, there exists a possibility that a tree being tagged as ingrowth at one measurement would not be "in" in either $^1/_{300}$-acre plot or BAF 20 point at a subsequent remeasurement.

5. The guidelines for numbering plots, especially nested plots, and trees that were previously addressed should be diligently adhered to. Without this careful documentation, compilation of stand attributes for more complex designs may become unduly complicated.

Cataloging of Data

For purposes of preparing a general catalog of data, complete description of sampling designs may not be necessary. There are currently many endeavors to catalog available permanent plot information on a specific subject or in a specific region for the purpose of data sharing and future planning of new permanent plot installations. Such catalogs do not require all known information about pertinent plots. They only need a general description for purposes of planning and summarization. Recording of information on specific plot numbers and linking variables can be deferred until stand attributes must be calculated for analysis procedures.

When collecting general permanent plot information from a wide variety of sources, it is often best to provide a survey form that specifically describes the needed information. Survey forms should be designed in as simple and uncluttered a fashion as possible so as not to bog the responder down in unnecessary detail or terminology but still obtain the pertinent information. A format for providing general sampling design information consistent with our data structure is provided below:

Use the following table to provide information on the sampling design for a stand. If the design has changed over time, fill out one table for each design.

Description of a Sampling Design

Year Sampling Began ________

	SAMPLING RULES[1]			
	1	2	. . .	*n*
PLOT TYPE[2]				
EXPANSION CONSTANT[3]				
NUMBER OF SUCH PLOTS				
KIND OF TREES SAMPLED WITH THIS PLOT TYPE[4]				

[1] Use as many columns as needed to describe your design. *n* = the number of sampling rules in the design.

[2] Plot type:

CON = fixed area plot or strip
BA = horizontal point sample
DBH = horizontal line sample
HTS = vertical point sample
HT = vertical line sample
ARB = subjective definition of sampling probabilities (3-P)

[3] Expansion constant:

If type = CON, then 1/plot area or 1/strip area
If type = BA, then BAF
and so forth

[4] Examples: Trees 1 to 3 inches d.b.h.
dead trees
and so forth.

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Maintaining permanent plot data with different sampling designs over long periods within an organization, and sharing such information between organizations, requires that common standards be used. A data structure for the description of the sampling design within a stand is proposed. It is composed of just those variables and their relationships needed to compile stand attributes and their variances. The data structure is able to incorporate changes in design that commonly occur through the life of a set of permanent plots. Using the data structure, seven actual or proposed designs, from simple to complex, are adequately described. Applications of the data structure for designing sampling schemes and for cataloging data are included.

KEYWORDS: permanent plots, data management systems, subsampling

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United States
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**Intermountain
Research Station**

General Technical
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Index to Information on Insects Associated With Western Wildland Shrubs

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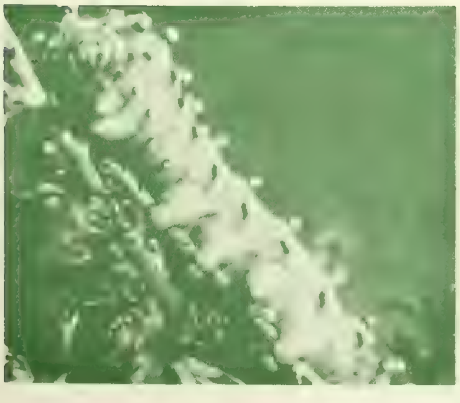

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The research reported here was accomplished under a cooperative agreement between the Intermountain Research Station and Utah State University. Much information related to shrub insects is not in published literature but is to be found in private files and the unpublished data of various scientists. Recognition and appreciation is therefore extended to entomologists who helped identify much of the literature indexed in the data base and who offered valuable suggestions regarding this project. These include G. F. Knowlton and G. E. Bohart of USU; William F. Barr and James B. Johnson, University of Idaho; Malcolm M. Furniss, Intermountain Research Station; and Patsy Schmidt, University of Wyoming.

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Front Cover, clockwise from upper left: a Malaise trap for assessing insects of a plant community; flatheaded or metallic wood borer, Buprestidae; mealybug, *Orthezia annae*; casebearer moth, *Coleophora*; and larva of the giant silkworm moth, Saturniidae.

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Index to Information on Insects Associated With Western Wildland Shrubs

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INTRODUCTION

Changes in the general image and economic importance of rangelands have intensified the need for a broader knowledge of rangeland biology. New laws requiring rehabilitation of rangelands disturbed by mining, road building, development of energy resources, etc., and the requirement of depositing escrow funds until fulfillment of rehabilitation requirements, have intensified the need for basic new information.

New demands for increased amounts and quality of native shrub seed have resulted in increased numbers of private plant material companies to meet the need for restoration and range improvements. But little is known about how to improve rangeland shrub seed production by protecting plants from injurious insects, or how to use insects as pollinators. Even commonly used agricultural practices of protecting seeds and seedlings from disease agents or insect attack are rarely used in the establishment and management of rangeland grasses or wildland shrubs. State Seed Laboratories are faced with entirely new problems in evaluating the quality of native rangeland plant seed. New information is needed on the factors that affect seed quality, on establishing standards for seed germination, and on the production of containerized or field-established plants.

Requests to use rangelands for recreation, increased food production, development of energy-producing products, deposits for nuclear wastes, or military and others uses have resulted in the legal requirement of environmental impact statements. For making a knowledgeable judgment, limited information exists on how such activities may interact with the biology of rangeland insects.

Results of some cooperative research projects to obtain basic information about the ecology of rangeland insects (for example, the Desert Biome Projects) have remained largely unpublished.

A starting point in increasing knowledge would be a retrieval system for existing information. It would serve as a useful tool for a large and diverse group of rangeland managers, extension agents, and scientists for improving present insect management, in setting research priorities, and in planning experimentation.

The objective of this publication is to provide a brief summary of available information on insects associated with wildland shrubs and to provide an index system to access information from published literature and insect collection records.

SCOPE

The scope of this publication is limited by botanical, geographic, chronological, and entomological restrictions.

Botanically, the index is limited to rangeland or wildland shrubs. Some plant species included may have agricultural or ornamental uses as well, but occur in wildlands. We made an effort to characterize the form of plants included. Treelike species may be contained in the genera *Acer, Alnus, Betula, Juniperus, Pinus, Quercus*, and *Salix.* Forblike species may be contained in the genera *Ambrosia, Amorpha, Artemisia, Dalea, Erigonum, Franseria, Haplopappus, Kochia*, and *Lupinus.* The definition of a tree or forb is open to interpretation, so the above genera are indicated only as a guideline. More latitude was given to forblike than treelike species. For example, *Quercus* species were not indexed unless they were shrublike species (such as *Quercus dumosa*), but with *Ambrosia* species were included even if no shrublike species was mentioned. To be indexed, plant species mentioned in literature or collection records had to be identified at least to genus. Thus, plant genera, species, subspecies, and varieties are included in the plant listing.

Geographically, the index is limited to the continental United States west of the 100th meridian, including States divided by this line. A few bibliographic records are included from British Columbia for insect species also occurring in the Western United States.

Chronologically, the index is limited to works published after 1899. Collection records currently included are primarily from the 1970's and 1980's.

Entomologically, the index is limited to insects that are associated with the included plant species. Thus, each bibliography or collection record must necessarily mention at least one insect-shrub association. However, it should be understood that an association may not necessarily represent actual utilization of a shrub by an insect. Relationships between insects and shrubs may be uncertain or incidental in some cases. For example, tenebrionid beetles are mentioned by several works in association with shrub communities, although specific host data are not given. Likewise, the associations of predators and parasites may be related to the prey and not directly to the prey host plant, and other insects may be only incidentally collected from plants on which they rest or visit for short durations. Conversely, there are many insect-shrub associations that represent a food or dwelling (biological) use of a shrub by an insect. The occurrence of the mesquite twig girder (*Oncideres rhodosticta*) on mesquite (*Prosopis* spp.), the Great Basin tent caterpillar (*Malacosoma californicum fragile*) on bitterbrush (*Purshia*), the sagebrush defoliator (*Aroga websteri*) on sagebrush (*Artemisia*), the cactus joint bug (*Chelinidea vittiger*) on prickly pear (*Opuntia*), and the canyon spindle gall midge (*Pinyonia edulicola*) on pinyon pine (*Pinus*) all represent well-documented examples of insects that have biological associations with rangeland shrubs. To be indexed, insect species mentioned in literature or collection records had to be identified at least to family. Thus, insect families, genera, species, subspecies, and varieties are included in the insect listing.

DESCRIPTION OF SECTIONS

The four major information sections in this publication are bibliography, collection, insect, and plant. Each section is divided into listings and indexes.

A listing contains summaries of information (literature, repositories, or scientific names) that are organized numerically. These listing numbers can in turn be found in the indexes. An index, because it is organized alphabetically, makes it easier to find a specific topic in the listings.

For example, to find a bibliography concerning a specific insect, you need to go to section I, Bibliography Information. Find the particular insect species name in the alphabetical index titled "Insect to Bibliography Index," listing numbers. Next, using the listing numbers, find the bibliographic references at the beginning of the section.

A more specific example: You wish to find names for species in the plant family Cornaceae. Looking in section IV, Plant Information, you find Cornaceae in the "Plant Family to Plant Index." There you find seven numbers that correspond to the "Plant Listing" at the beginning of the section. The names of the plants in Cornaceae can be determined by locating each of these seven numbers in the "Plant Listing."

All information contained in this publication was compiled on a microcomputer database system, which performed the tasks of storage and retrieval. Additional information may be added to this system as it becomes available.

Bibliography

Section I, the bibliography, was compiled from three sources: computer database searches, library searches, and personal files. There is a single listing and five accompanying indexes. All indexes of this section refer to the bibliographic listing.

Each bibliographic entry in the listing contains the following information: author(s) names(s), publication year, subject title, publication title, volume and issue (or other series number), and page numbers. Indexes contain information on insect scientific name, plant scientific name, author name, subject, or title keyword.

Literature in the bibliography was examined wherever possible and indexed according to subject matter. Materials not available for examination were indexed based on the title of the work. The results of this process are summarized in the "Subject to Bibliography Index." The depth of information varies widely among works, and many works contain information pertaining to more than one subject. A brief review of the subject matter covered by the literature will be given here.

The first five topics of the subject index deal with aspects of insect biology, control, damage, distribution, and taxonomy. Insect distributional information was the most often encountered topic, followed by taxonomy, damage description, biology, and control.

Insect biology has been studied in detail for a few of the more important range pests. However, the biology and life histories of most of the insects included are unknown or are not discussed with respect to specific range plant hosts.

Insect control has only been studied for a few of the more important range pests or other insects that are considered economically important. Migration of pests from range plants has been detected for certain insects that are also found in agricultural situations, but this factor has been given little consideration in control schemes.

Distribution information ranges from extensive regional summaries of insect distribution to brief collection accounts. While the usefulness of brief accounts is limited when they are considered by themselves, such information may be useful if summarized. Distributional information is also contained within many works that have biological or taxonomic topics as their major emphasis.

Information on insect damage consists of accounts of insect outbreaks, descriptions of damage, and observations of feeding. Outbreaks of range pests are often noted in some of the major range journals. Other damage accounts or feeding observations are given for insects of economic importance and may be included within works dealing with insect biology. Some major works contain insect damage descriptions for many species.

Insect taxonomic information and species descriptions may be contained in major works, such as reviews or revisions, but primarily occur in less comprehensive works. Much of this information is contained in descriptions of new species, which are commonly encountered in the literature.

The next four topics of the "Subject to Bibliography Index," deal with host plant-insect relationships and aspects of host plant biology and ecology. Host plant-insect relationships are mentioned most often, followed by host plant listings, biological aspects, and ecological aspects.

Comprehensive host plant or food plant listings have been produced for a variety of insects. Such listings often include important range plants. Abundance and associational studies of the insect fauna of specific plants have been examined in several works. Many works of these types contain only a list of plant or insect species, with little other information.

Host plant-insect relationships and the coevolution of plant and insect have received much attention in recent literature. However, relatively few of these works mention range plants.

Dietary studies have been conducted mainly with grasshoppers found on rangeland. Works dealing with this subject are quite extensive and have been produced in several Western States.

Studies of pollinators of range plants are rather rare. This topic deserves further investigation because pollination may have a profound effect on plant production.

Host plant physiology, anatomy, and pathology, as they relate to insects, have received little attention. As plant resistance is often related to plant physiology or anatomy, further studies of insect-plant relationships at this level are certainly justifiable.

Plant ecology and plant community relationships to insects have also received little attention. Plant ecology studies sometimes mention insect relationships, but this aspect is generally given secondary treatment. Far more information is given for soil and water relations, for example, than for insect relations. The relationship between insects and range plant communities has been the subject of a few ecological studies.

The remaining topics of the "Subject to Bibliography Index" are related to aspects of range management and to specific types of plant losses or damage. Plant productivity, forage losses, and defoliation are mentioned most often, followed by wood damage and wood pests, seed production and predation, gall formation and gall-forming insects, control of noxious weeds, soil relations, management practices related to insects, and revegetation or plant establishment.

Specific information about range management as it relates to insects is scarce. Grazing and burning are the only range practices mentioned in conjunction with insect control. A few works on rangeland entomology specifically are included with this topic.

Revegetation and plant establishment, although an extremely important topic recently, seldom considers insects. The effect of insects on such practices is apparently little understood and has not been investigated in detail. Control of noxious shrubs with insects is mentioned for a few range plants. Control of cactus is the subject most often encountered.

Plant productivity, forage losses, and defoliation are mentioned in a few dozen works, but specific economic data are seldom included.

Seed production and predation have not been examined in detail except for a few range plants such as bitterbrush. Several works mention the effects of harvester ants on seed production in plant communities.

Gall formation and gall-forming insects are a fairly popular topic in the literature. However, little is apparently known about the effects such galls have on the host plants.

Wood damage and wood-damaging insects have received some attention in rangeland entomology. However, as with studies of plant productivity and defoliation, specific economic data are seldom included, and the actual effect of such insects on production is unknown.

In summary, there is a deficit of information dealing specifically with the effect of insects on range plants. There are many areas of range entomology where further study is justified and necessary. Practical and useful management or control practices cannot be devised without a clear understanding of insect biology and host plant relationships. Such work will most likely be performed first with useful range shrubs, but the relationships of less useful or noxious shrubs may also be important in the overall range ecosystem and should not be ignored. Undoubtedly many insect species may be causing damage that is not recognized, or species may be providing benefits of which we are not aware.

Collection

Section II, the collection portion of this publication, contains information about insects collected from rangeland shrubs in Utah, Wyoming, and Idaho. Information from other Western States was requested but unavailable for a variety of reasons.

The collection information section contains one listing and two accompanying indexes.

The "collection listing" contains the following: State, county, and date of collection, host plant, collection method, number of collection units, elevation of the collection site, and location of the stored specimens. State, county, date, host plant, and insect species are included for all items listed. Other information is given where available or applicable.

The indexes allow collection records to be located according to insect and plant scientific names. All indexes of this section refer to the collection listing.

The relationships between insects and shrub species mentioned in collection records may be uncertain or incidental in certain cases. Many of the collections were made by sweep net, and actual observations of insects feeding on specific plants were not made. Thus, the insect and plant indexes provide a list of potential insect visitors of a plant, or of potential plant hosts of an insect. Numerical data for some insects collected from range shrubs are currently stored on the computer database system, and such information may help elucidate some of these insect-plant relationships. However, these numerical data are not easily presented in a summarized form and must be obtained directly from the computer database.

Insect

Section III, the insect information, currently contains about 6,000 insect species. Some of these insects may be indexed under more than one name because no specific attempt was made to determine synonomy. Synonyms are noted in a few cases where such information was encountered in the literature.

Insect information is contained in two listings and in four accompanying indexes.

Each item in the "Insect Listing" may contain the following: insect scientific name, common name, authority, family, order, immature and adult guild, immature and adult size range in millimeters, overwintering stage or stages, oviposition medium, and number of generations per year. Insect family and order were determined for nearly all records. For those unfamiliar with the term, "insect guild" refers to the feeding or life habits of a particular insect. Such descriptions as "leaf feeder," "gall former," "bark beetle," "scavenger," and "endoparasite" are all examples of insect guilds. Guilds and other information are presented where available.

An "Insect Family Listing" is also included in this section.

The indexes allow insect information to be located according to insect family, order, immature guild, and adult guild. All indexes refer to the "Insect Listing," except the "Insect Order to Family Index," which refers to the "Insect Family Listing."

Plant

Section IV, on plant species, contains about 1,100 species' names. Some of these plants, as with insects, may be indexed under more than one scientific name. Some plants in the listing may have no corresponding bibliography or collection indexes in cases where no information was found.

The plant information section contains one listing and two indexes.

Each record in the "Plant Listing" may contain the following: plant scientific name, common name, authority, family, height range in centimeters, major uses, palatability rating, and percentage crude protein. Plant scientific name was required for all records, and plant families have been determined for virtually all records. Other information is presented where it was available.

The indexes allow plant listing information to be located according to either plant family or common name.

ERRORS AND INCONSISTENCIES

Certain errors or inconsistencies may have been perpetuated during the production of this index. Although the computer system used to compile information could detect spelling errors during data entry, certain other inconsistencies have not been resolved. For example, spelling variations of scientific names are often found in the literature, such as *Euttetix tenellus* versus *Eutettix tenella.* Generally, spelling variations were included in the insect or plant listings except where obvious typographical errors existed. Some equivalent spellings, such as *Pachybrachis* and *Pachybrachys*, are simply cross-indexed in the listings.

Insect names have been examined for spelling errors by two insect taxonomists, and much effort has been invested to assure correct spellings in the completed indexes. Even so, some errors may have escaped detection. The authors would appreciate any corrections users of the indexes wish to offer.

ADDITIONS TO THE DATABASE

The computer system used to store information for this publication is capable of being updated with new information as it becomes available. New literature regarding insects associated with rangeland shrubs, as well as additional collection information, may be added to the system.

The authors anticipate that future additions to the database will be published as supplements to this index. We welcome any contributions or suggestions users of this index wish to offer.

SECTION I: BIBLIOGRAPHY INFORMATION

Bibliography Listing

This listing contains bibliographic information. See "Description of the Sections" for details about the information included in the listing. Items in the listing are organized numerically and are located using one of the five indexes that follow in this section.

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SECTION II: COLLECTION INFORMATION

Collection Listing

This listing contains collection information. See "Description of the Sections" for details about the information included in the listing. Items in the listing are organized numerically and are located using one of the two indexes that follow in this section.

1 WY. Lincoln Co. 13 September 1983 Artemisia tridentata (USU)

2 WY. Lincoln Co. 13 July 1983 Sarcobatus vermiculatus (USU)

3 WY. Lincoln Co. 13 July 1983 Artemisia spinosa (USU)

4 WY. Lincoln Co. 13 July 1983 Artemisia arbuscula (USU)

5 WY. Lincoln Co. 13 July 1983 Chrysothamnus viscidiflorus (USU)

6 WY. Lincoln Co. 24 August 1982 Chrysothamnus nauseosus (USU)

7 WY. Lincoln Co. 22 September 1983 Sarcobatus spp. (USU)

8 WY. Lincoln Co. 22 September 1983 Amelanchier spp. (USU)

9 WY. Lincoln Co. 22 September 1983 Artemisia tridentata (USU)

10 WY. Lincoln Co. 22 September 1983 Artemisia spp. (USU)

11 WY. Lincoln Co. 22 September 1983 Chrysothamnus spp. (USU)

12 WY. Lincoln Co. 24 August 1983 Amelanchier spp. (USU)

13 WY. Lincoln Co. 24 August 1983 Purshia spp. (USU)

14 WY. Lincoln Co. 24 August 1983 Symphoricarpos spp. (USU)

15 WY. Lincoln Co. 24 August 1983 Artemisia tridentata tridentata (USU)

16 WY. Lincoln Co. 24 August 1983 Artemisia nova (USU)

17 WY. Lincoln Co. 24 August 1983 Sarcobatus spp. (USU)

18 WY. Lincoln Co. 24 August 1983 Artemisia spp. (USU)

19 WY. Lincoln Co. 24 August 1983 Chrysothamnus spp. (USU)

20 WY. Lincoln Co. 24 August 1983 Artemisia spinescens (USU)

21 UT. Uintah Co. 30 August 1975 Chrysothamnus nauseosus (USU)

22 UT. Uintah Co. 30 August 1975 Chrysothamnus viscidiflorus (USU)

23 UT. Uintah Co. 30 August 1975 Sarcobatus vermiculatus (USU)

24 UT. Uintah Co. 30 August 1975 Salix spp. (USU)

25 UT. Uintah Co. 30 August 1975 Tamarix gallica (USU)

26 UT. Uintah Co. 30 August 1975 Gutierrezia sarothrae (USU)

27 UT. Uintah Co. 30 August 1975 Eriogonum spp. (USU)

28 UT. Uintah Co. 30 August 1975 Artemisia tridentata (USU)

29 UT. Uintah Co. 30 August 1975 Artemisia ludoviciana (USU)

30 UT. Uintah Co. 11 July 1974 Tamarix spp. (USU)

31 UT. Uintah Co. 11 July 1974 Clematis ligusticifolia (USU)

32 UT. Uintah Co. 11 July 1974 Chrysothamnus nauseosus (USU)

33 UT. Uintah Co. 11 July 1974 Tamarix gallica (USU)

34 UT. Uintah Co. 24 July 1974 Chrysothamnus nauseosus (USU)

35 UT. Uintah Co. 24 July 1974 Atriplex spp. (USU)

36 UT. Uintah Co. 24 July 1974 Artemisia tridentata (USU)

37 UT. Uintah Co. 24 July 1974 Clematis ligusticifolia (USU)

38 UT. Uintah Co. 24 July 1974 Rhus ovata (USU)

39 UT. Uintah Co. 24 July 1974 Amelanchier spp. (USU)

40 UT. Uintah Co. 8 August 1976 Chrysothamnus nauseosus (USU)

41 UT. Uintah Co. 8 August 1976 Clematis ligusticifolia (USU)

42 UT. Uintah Co. 30 June 1975 Chrysothamnus nauseosus (USU)

43 UT. Uintah Co. 20 May 1976 Chrysothamnus nauseosus (USU)

44 UT. Uintah Co. 20 May 1976 Sarcobatus spp. (USU)

45 UT. Uintah Co. 20 May 1976 Ambrosia spp. (USU)

46 UT. Uintah Co. 20 May 1976 Salix spp. (USU)

47 UT. Uintah Co. 20 May 1976 Sarcobatus vermiculatus (USU)

48 UT. Uintah Co. 7 June 1975 Sarcobatus vermiculatus (USU)

49 UT. Uintah Co. 7 June 1975 Atriplex spp. (USU)

50 UT. Uintah Co. 7 June 1975 Amelanchier spp. (USU)

51 UT. Uintah Co. 7 June 1975 Tetradymia canescens (USU)

52 UT. Uintah Co. 7 June 1975 Salix spp. (USU)

53 UT. Uintah Co. 7 June 1975 Chrysothamnus nauseosus (USU)

54 UT. Uintah Co. 7 June 1975 Chrysothamnus spp. (USU)

55 UT. Box Elder Co. 21 August 1973 Chrysothamnus viscidiflorus (USU)

56 UT. Box Elder Co. 21 August 1973 Atriplex confertifolia (USU)

57 UT. Uintah Co. 14 July 1975 Sarcobatus vermiculatus (USU)

58 UT. Uintah Co. 14 July 1975 Atriplex canescens (USU)

59 UT. Uintah Co. 14 July 1975 Chrysothamnus spp. (USU)

60 UT. Uintah Co. 14 July 1975 Chrysothamnus viscidiflorus (USU)

61 UT. Uintah Co. 14 July 1975 Atriplex spp. (USU)

62 UT. Uintah Co. 14 July 1975 Chrysothamnus nauseosus (USU)

63 UT. Uintah Co. 14 July 1975 Tamarix spp. (USU)

64 UT. Uintah Co. 14 July 1975 Juniperus spp. (USU)

65 UT. Uintah Co. 14 July 1975 Salix spp. (USU)

66 UT. Uintah Co. 14 July 1975 Tetradymia canescens (USU)

67 UT. Uintah Co. 14 July 1975 Artemisia tridentata (USU)

68 UT. Uintah Co. 4 August 1976 Artemisia spp. (USU)

69 UT. Uintah Co. 4 August 1976 Tamarix gallica (USU)

70 UT. Uintah Co. 4 August 1976 Salix spp. (USU)

71 UT. Uintah Co. 4 August 1976 Clematis ligusticifolia (USU)

72 UT. Uintah Co. 4 August 1976 Rhus ovata (USU)

73 UT. Uintah Co. 4 August 1976 Chrysothamnus spp. (USU)

74 UT. Uintah Co. 4 August 1976 Chrysothamnus viscidiflorus (USU)

75 ID. Bonneville Co. 21 July 1975 Tetradymia canescens (USU)

76 ID. Bonneville Co. 21 July 1975 Chrysothamnus spp. (USU)

77 ID. Bonneville Co. 21 July 1975 Atriplex canescens (USU)

78 ID. Bonneville Co. 21 July 1975 Tetradymia spp. (USU)

79 UT. Uintah Co. 9 September 1976 Amelanchier spp. (USU)

80 UT. Uintah Co. 9 September 1976 Rhus trilobata (USU)

81 UT. Uintah Co. 9 September 1976 Chrysothamnus nauseosus (USU)

82 UT. Uintah Co. 9 September 1976 Salix spp. (USU)

83 UT. Uintah Co. 9 September 1976 Gutierrezia sarothrae (USU)

84 UT. Uintah Co. 9 September 1976 Tamarix gallica (USU)

85 UT. Uintah Co. 9 September 1976 Atriplex spp. (USU)

86 UT. Uintah Co. 9 September 1976 Artemisia tridentata (USU)

87 UT. Uintah Co. 9 September 1976 Rhus ovata (USU)

88 UT. Uintah Co. 18 September 1975 Artemisia tridentata (USU)

89 UT. Uintah Co. 18 September 1975 Sarcobatus vermiculatus (USU)

90 UT. Uintah Co. 18 September 1975 Eriogonum spp. (USU)

91 UT. Uintah Co. 18 September 1975 Chrysothamnus viscidiflorus (USU)

92 UT. Uintah Co. 18 September 1975 Chrysothamnus nauseosus (USU)

93 UT. Uintah Co. 18 September 1975
Salix exigua (USU)

94 UT. Uintah Co. 18 September 1975
Salix spp. (USU)

95 UT. Uintah Co. 18 September 1975
Rhus trilobata (USU)

96 UT. Box Elder Co. 12 June 1973
Chrysothamnus viscidiflorus (USU)

97 UT. Box Elder Co. 12 June 1973
Atriplex confertifolia (USU)

98 UT. Box Elder Co. 12 June 1973
Artemisia tridentata (USU)

99 UT. Uintah Co. 10 September 1976
Eriogonum spp. (USU)

100 UT. Uintah Co. 10 September 1976
Chrysothamnus nauseosus (USU)

101 UT. Uintah Co. 10 September 1976
Artemisia spp. (USU)

102 UT. Uintah Co. 10 September 1976
Clematis ligusticifolia (USU)

103 UT. Uintah Co. 10 September 1976
Tamarix gallica (USU)

104 UT. Uintah Co. 10 September 1976
Tamarix spp. (USU)

105 UT. Box Elder Co. 17 July 1973
Artemisia tridentata (USU)

106 UT. Box Elder Co. 17 July 1973
Chrysothamnus viscidiflorus (USU)

107 UT. Box Elder Co. 17 July 1973
Atriplex confertifolia (USU)

108 UT. Box Elder Co. 24 July 1973
Artemisia tridentata (USU)

109 UT. Box Elder Co. 24 July 1973
Chrysothamnus viscidiflorus (USU)

110 UT. Uintah Co. 3 July 1973
Chrysothamnus viscidiflorus (USU)

111 UT. Box Elder Co. 10 July 1973
Artemisia tridentata (USU)

112 UT. Box Elder Co. 10 July 1973
Atriplex confertifolia (USU)

113 UT. Box Elder Co. 10 July 1973
Chrysothamnus viscidiflorus (USU)

114 UT. Box Elder Co. 7 June 1973
Artemisia tridentata (USU)

115 UT. Box Elder Co. 7 June 1973
Atriplex spp. (USU)

116 UT. Box Elder Co. 7 June 1973
Chrysothamnus viscidiflorus (USU)

117 UT. Box Elder Co. 7 June 1973
Atriplex confertifolia (USU)

118 UT. Box Elder Co. 31 July 1973
Atriplex confertifolia (USU)

119 UT. Box Elder Co. 31 July 1973
Chrysothamnus viscidiflorus (USU)

120 UT. Box Elder Co. 31 July 1973
Artemisia tridentata (USU)

121 UT. Box Elder Co. 3 September 1973
Atriplex confertifolia (USU)

122 UT. Box Elder Co. 3 September 1973
Chrysothamnus viscidiflorus (USU)

123 UT. Box Elder Co. 3 September 1973
Artemisia tridentata (USU)

124 UT. Box Elder Co. 7 August 1973
Chrysothamnus viscidiflorus (USU)

125 UT. Box Elder Co. 7 August 1973
Chrysothamnus spp. (USU)

126 UT. Box Elder Co. 7 August 1973
Artemisia tridentata (USU)

127 UT. Box Elder Co. 7 August 1973
Chrysothamnus viscidiflorus (USU)

128 UT. Box Elder Co. 7 August 1973
Atriplex confertifolia (USU)

129 UT. Uintah Co. 11 August 1974
Chrysothamnus nauseosus (USU)

130 UT. Uintah Co. 8 August 1974 Rhus
ovata (USU)

131 UT. Uintah Co. 8 August 1974 Salix
spp. (USU)

132 UT. Uintah Co. 8 August 1974
Clematis ligusticifolia (USU)

133 UT. Uintah Co. 8 August 1974
Chrysothamnus nauseosus (USU)

134 UT. Uintah Co. 8 August 1974
Tamarix spp. (USU)

135 UT. Uintah Co. 10 August 1974
Eriogonum spp. (USU)

136 UT. Uintah Co. 7 June 1976
Chrysothamnus viscidiflorus (USU)

137 UT. Uintah Co. 7 June 1976
Sarcobatus vermiculatus (USU)

138 UT. Uintah Co. 7 June 1976 Atriplex
confertifolia (USU)

139 UT. Uintah Co. 7 June 1976
Chrysothamnus nauseosus (USU)

140 UT. Uintah Co. 7 June 1976 Tamarix
gallica (USU)

141 UT. Uintah Co. 7 June 1976 Atriplex canescens (USU)

142 UT. Uintah Co. 7 June 1976 Salix exigua (USU)

143 UT. Uintah Co. 7 June 1976 Artemisia tridentata (USU)

144 UT. Uintah Co. 7 June 1976 Salix spp. (USU)

145 UT. Uintah Co. 7 June 1976 Amelanchier spp. (USU)

146 UT. Uintah Co. 7 June 1976 Tamarix spp. (USU)

147 UT. Uintah Co. 7 June 1976 Rhus trilobata (USU)

148 UT. Uintah Co. 7 June 1976 Atriplex spp. (USU)

149 ID. Bonneville Co. 6 July 1975 Chrysothamnus spp. (USU)

150 ID. Bonneville Co. 6 July 1975 Artemisia spp. (USU)

151 UT. Box Elder Co. 9 May 1974 Atriplex confertifolia (USU)

152 UT. Box Elder Co. 9 May 1974 Artemisia tridentata (USU)

153 UT. Box Elder Co. 9 May 1974 Chrysothamnus viscidiflorus (USU)

154 UT. Uintah Co. 8 July 1976 Chrysothamnus viscidiflorus (USU)

155 UT. Uintah Co. 8 July 1976 Tamarix gallica (USU)

156 UT. Uintah Co. 8 July 1976 Chrysothamnus nauseosus (USU)

157 UT. Uintah Co. 8 July 1976 Salix exigua (USU)

158 UT. Uintah Co. 8 July 1976 Salix spp. (USU)

159 UT. Uintah Co. 8 July 1976 Atriplex canescens (USU)

160 UT. Uintah Co. 8 July 1976 Chrysothamnus spp. (USU)

161 UT. Box Elder Co. 14 August 1973 Atriplex confertifolia (USU)

162 UT. Box Elder Co. 14 August 1973 Chrysothamnus viscidiflorus (USU)

163 UT. Box Elder Co. 14 August 1973 Artemisia tridentata (USU)

164 UT. Box Elder Co. 26 June 1973 Chrysothamnus viscidiflorus (USU)

165 UT. Box Elder Co. 26 June 1973 Atriplex confertifolia (USU)

166 UT. Box Elder Co. 26 June 1973 Artemisia tridentata (USU)

167 UT. Box Elder Co. 29 May 1974 Tamarix gallica (USU)

168 UT. Box Elder Co. 29 May 1974 Atriplex confertifolia (USU)

169 UT. Box Elder Co. 29 May 1974 Chrysothamnus viscidiflorus (USU)

170 UT. Box Elder Co. 29 May 1974 Artemisia tridentata (USU)

171 UT. Uintah Co. 14 July 1976 Sarcobatus vermiculatus (USU)

172 UT. Uintah Co. 14 July 1976 Chrysothamnus spp. (USU)

173 UT. Uintah Co. 14 July 1976 Artemisia tridentata (USU)

174 UT. Uintah Co. 14 July 1976 Artemisia ludoviciana (USU)

175 UT. Uintah Co. 14 July 1976 Chrysothamnus nauseosus (USU)

176 UT. Uintah Co. 14 July 1976 Atriplex canescens (USU)

177 UT. Uintah Co. 14 July 1976 Holodiscus discolor (USU)

178 UT. Uintah Co. 14 July 1976 Sarcobatus spp. (USU)

179 UT. Box Elder Co. 22 May 1974 Atriplex confertifolia (USU)

180 UT. Box Elder Co. 22 May 1974 Chrysothamnus viscidiflorus (USU)

181 UT. Box Elder Co. 22 May 1974 Artemisia tridentata (USU)

182 UT. Uintah Co. 16 August 1975 Chrysothamnus nauseosus (USU)

183 ID. Bonneville Co. 12 July 1975 Eriogonum spp. (USU)

184 ID. Bonneville Co. 12 July 1975 Chrysothamnus spp. (USU)

185 UT. Uintah Co. 6 June 1976 Chrysothamnus nauseosus (USU)

186 UT. Uintah Co. 6 June 1976 Sarcobatus vermiculatus (USU)

187 UT. Uintah Co. 6 June 1976 Gutierrezia sarothrae (USU)

188 UT. Uintah Co. 6 June 1976 Artemisia tridentata (USU)

189 UT. Uintah Co. 18 May 1975
Artemisia spp. (USU)

190 UT. Uintah Co. 13 May 1975
Amelanchier spp. (USU)

191 UT. Uintah Co. 13 May 1975
Artemisia spp. (USU)

192 UT. Box Elder Co. 16 April 1974
Artemisia tridentata (USU)

193 UT. Box Elder Co. 16 April 1974
Atriplex confertifolia (USU)

194 UT. Box Elder Co. 3 July 1973
Atriplex confertifolia (USU)

195 UT. Box Elder Co. 3 July 1973
Chrysothamnus viscidiflorus (USU)

196 UT. Box Elder Co. 3 July 1973
Chrysothamnus spp. (USU)

197 UT. Box Elder Co. 19 June 1973
Chrysothamnus viscidiflorus (USU)

198 UT. Box Elder Co. 19 June 1973
Atriplex confertifolia (USU)

199 UT. Box Elder Co. 19 June 1973
Artemisia tridentata (USU)

200 UT. Box Elder Co. 9 May 1975
Chrysothamnus viscidiflorus (USU)

201 UT. Uintah Co. 30 June 1976
Chrysothamnus nauseosus (USU)

202 UT. Uintah Co. 30 June 1976 Salix
exigua (USU)

203 UT. Uintah Co. 7 June 1984 Salix
spp. (USU)

204 UT. Uintah Co. 10 July 1974
Eriogonum spp. (USU)

205 UT. Uintah Co. 10 July 1974
Chrysothamnus nauseosus (USU)

206 UT. Uintah Co. 10 July 1974 Tamarix
spp. (USU)

207 UT. Box Elder Co. 26 April 1974
Chrysothamnus viscidiflorus (USU)

208 UT. Box Elder Co. 26 April 1974
Artemisia tridentata (USU)

209 UT. Box Elder Co. 17 May 1974
Atriplex confertifolia (USU)

210 UT. Box Elder Co. 17 May 1974
Artemisia spp. (USU)

211 UT. Box Elder Co. 17 May 1974
Artemisia tridentata (USU)

212 UT. Box Elder Co. 17 May 1974
Chrysothamnus viscidiflorus (USU)

213 UT. Box Elder Co. 21 April 1974
Atriplex confertifolia (USU)

214 UT. Box Elder Co. 27 June 1973
Atriplex confertifolia (USU)

215 UT. Box Elder Co. 27 June 1973
Chrysothamnus viscidiflorus (USU)

216 UT. Box Elder Co. 7 July 1973
Chrysothamnus viscidiflorus (USU)

217 UT. Box Elder Co. 7 July 1973
Atriplex confertifolia (USU)

218 UT. Uintah Co. 20 September 1976
Eriogonum spp. (USU)

219 UT. Uintah Co. 20 September 1976
Chrysothamnus nauseosus (USU)

220 UT. Uintah Co. 26 May 1976 Ambrosia
spp. (USU)

221 UT. Box Elder Co. 14 September 1973
Atriplex confertifolia (USU)

222 UT. Box Elder Co. 14 September 1973
Artemisia tridentata (USU)

223 UT. Box Elder Co. 19 May 1975
Chrysothamnus viscidiflorus (USU)

224 UT. Box Elder Co. 19 May 1975
Atriplex confertifolia (USU)

225 UT. Box Elder Co. 2 May 1975
Chrysothamnus viscidiflorus (USU)

226 UT. Box Elder Co. 2 May 1975
Artemisia tridentata (USU)

227 UT. Box Elder Co. 2 June 1975
Chrysothamnus viscidiflorus (USU)

228 UT. Box Elder Co. 2 June 1975
Artemisia tridentata (USU)

229 UT. Box Elder Co. 2 June 1975
Atriplex confertifolia (USU)

230 UT. Uintah Co. 16 July 1975 Tamarix
gallica (USU)

231 UT. Uintah Co. 3 July 1976
Chrysothamnus nauseosus (USU)

232 UT. Uintah Co. 9 September 1971
Tamarix gallica (USU)

233 UT. Uintah Co. 7 July 1976
Chrysothamnus nauseosus (USU)

234 UT. Box Elder Co. 27 August 1973
Atriplex confertifolia (USU)

235 UT. Box Elder Co. 27 August 1973
Chrysothamnus nauseosus (USU)

236 UT. Box Elder Co. 27 August 1973
Artemisia tridentata (USU)

237 UT. Box Elder Co. 4 May 1974
Atriplex confertifolia (USU)

238 UT. Box Elder Co. 4 May 1974
Chrysothamnus viscidiflorus (USU)

239 UT. Box Elder Co. 4 May 1974
Artemisia tridentata (USU)

240 UT. Box Elder Co. 13 June 1974
Artemisia tridentata (USU)

241 UT. Uintah Co. 19 July 1975
Atriplex canescens (USU)

242 ID. Bonnevile Co. 12 July 1975
Eriogonum spp. (USU)

243 WY. Lincoln Co. 4 September 1980
Artemisia tridentata (USU)

244 WY. Lincoln Co. 13 August 1980
Chrysothamnus spp. (USU)

245 WY. Lincoln Co. 3 July 1980
Tetradymia canescens (USU)

246 WY. Lincoln Co. 31 July 1980
Sarcobatus vermiculatus (USU)

247 UT. Uintah Co. 16 July 1976 Tamarix gallica (USU)

248 ID. Bonneville Co. 20 July 1975
Tetradymia canescens (USU)

249 UT. Box Elder Co. 4 June 1975
Artemisia tridentata (USU)

250 UT. Unitah Co. 9 September 1976
Chrysothamnus nauseosus (USU)

251 UT. Box Elder Co. 18 May 1975
Artemisia tridentata (USU)

252 UT. Box Elder Co. 26 May 1975
Chrysothamnus viscidiflorus (USU)

253 UT. Box Elder Co. 26 May 1975
Artemisia tridentata (USU)

254 UT. Box Elder Co. 10 August 1972
Chrysothamnus viscidiflorus (USU)

255 UT. Box Elder Co. 14 August 1974
Atriplex confertifolia (USU)

256 UT. Davis Co. 11 June 1963 Purshia tridentata (USU)

257 UT. Davis Co. 10 October 1953
Purshia tridentata (USU)

258 UT. Box Elder Co. 12 August 1973
Artemisia tridentata (USU)

259 UT. Box Elder Co. 12 June 1973
Chrysothamnus viscidiflorus (USU)

260 UT. Box Elder Co. 12 June 1973
Artemisia tridentata (USU)

261 ID. Oneida Co. 13 September 1973
Chrysothamnus spp. (USU)

262 UT. Box Elder Co. 9 May 1975
Artemisia tridentata (USU)

263 ID. Bonneville Co. 12 July 1975
Artemisia spp. (USU)

264 ID. Bonneville Co. 12 July 1975
Tetradymia canescens (USU)

265 UT. Uintah Co. 18 September 1975
Artemisia spp. (USU)

266 UT. Box Elder Co. 29 May 1974
Artemisia spp. (USU)

267 WY. Lincoln Co. 27 May 1980
Symphoricarpos spp. (USU)

268 UT. Box Elder Co. 16 April 1974
Chrysothamnus viscidiflorus (USU)

269 UT. Uintah Co. 12 June 1975 Yucca spp. (USU)

270 ID. Kootenai Co. 12 May 1950 Rubus spp. (USU)

271 UT. Uintah Co. 7 June 1975
Juniperus spp. (USU)

272 UT. Uintah Co. 9 September 1976
Juniperus spp. (USU)

273 UT. Uintah Co. 30 August 1975
Juniperus spp. (USU)

274 UT. Uintah Co. 8 August 1976
Juniperus spp. (USU)

275 UT. Uintah Co. 8 July 1976
Juniperus spp. (USU)

276 UT. Uintah Co. 6 June 1975
Juniperus spp. (USU)

277 ID. Bonneville Co. 6 July 1975
Juniperus spp. (USU)

278 UT. Uintah Co. 4 August 1976
Amelanchier spp. (USU)

279 UT. Uintah Co. 4 August 1976
Chrysothamnus nauseosus (USU)

280 ID. Owyhee Co. 10 June 1968
Artemisia tridentata (USU)

281 ID. Blain Co. 21 June 1968
Artemisia tridentata (USU)

282 UT. Uintah Co. 6 June 1976
Juniperus spp. (USU)

283 UT. Uintah Co. 9 September 1976
Sarcobatus vermiculatus (USU)

284 UT. Box Elder Co. 14 September 1973
Chrysothamnus viscidiflorus (USU)

285 UT. Box Elder Co. 9 May 1975 Atriplex confertifolia (USU)

286 UT. Uintah Co. 9 June 1976 Sarcobatus vermiculatus (USU)

287 UT. Uintah Co. 30 August 1975 Rhus ovata (USU)

288 ID. Bonneville Co. 7 June 1975 Artemisia spp. (USU)

289 ID. Bonneville Co. 6 July 1975 Artemisia spinescens (USU)

290 UT. Box Elder Co. 4 May 1975 Chrysothamnus viscidiflorus (USU)

291 UT. Uintah Co. 9 September 1976 Clematis ligusticifolia (USU)

292 UT. Uintah Co. 13 May 1975 Ribes aureum (USU)

293 UT. Box Elder Co. 24 July 1973 Atriplex confertifolia (USU)

294 UT. Uintah Co. 7 June 1975 Ribes aureum (USU)

295 UT. Uintah Co. 10 September 1975 Opuntia spp. (USU)

296 UT. Uintah Co. 30 August 1975 Cowania spp. (USU)

297 UT. Uintah Co. 9 September 1976 Atriplex confertifolia (USU)

298 UT. Uintah Co. 10 September 1976 Chrysothamnus viscidiflorus (USU)

299 UT. Box Elder Co. 27 June 1973 Artemisia tridentata (USU)

300 UT. Box Elder Co. 3 July 1973 Artemisia tridentata (USU)

301 UT. Box Elder Co. 26 August 1969 Chrysothamnus viscidiflorus (USU)

302 UT. Box Elder Co. 10 August 1973 Chrysothamnus viscidiflorus (USU)

303 WY. Lincoln Co. 12 September 1979 Artemisia tridentata (USU)

304 WY. Lincoln Co. 17 July 1980 Sarcobatus vermiculatus (USU)

305 WY. Lincoln Co. 27 May 1980 Prunus virginiana (USU)

306 WY. Lincoln Co. 27 May 1980 Artemisia spp. (USU)

307 WY. Lincoln Co. 12 September 1979 Chrysothamnus nauseosus (USU)

308 WY. Lincoln Co. 24 June 1980 Juniperus scopulorum (USU)

309 WY. Lincoln Co. 12 September 1979 Amelanchier spp. (USU)

310 WY. Lincoln Co. 12 September 1979 Symphoricarpos spp. (USU)

311 WY. Lincoln Co. 27 May 1980 Juniperus scopulorum (USU)

312 WY. Lincoln Co. 24 June 1980 Ceratoides lanata (USU)

313 WY. Lincoln Co. 27 May 1980 Artemisia tridentata (USU)

314 WY. Lincoln Co. 9 July 1980 Artemisia tridentata (USU)

315 WY. Lincoln Co. 4 September 1980 Artemisia spp. (USU)

316 WY. Lincoln Co. 9 July 1980 Juniperus scopulorum (USU)

317 WY. Lincoln Co. 27 May 1980 Amelanchier spp. (USU)

318 WY. Lincoln Co. 27 June 1980 Chrysothamnus viscidiflorus (USU)

319 WY. Lincoln Co. 3 July 1980 Artemisia tridentata (USU)

320 WY. Lincoln Co. 24 July 1980 Eriogonum spp. (USU)

321 WY. Lincoln Co. 31 July 1980 Chrysothamnus nauseosus (USU)

322 WY. Lincoln Co. 17 July 1980 Chrysothamnus nauseosus (USU)

323 WY. Lincoln Co. 31 July 1980 Artemisia spp. (USU)

324 WY. Lincoln Co. 21 August 1980 Chrysothamnus nauseosus (USU)

325 WY. Lincoln Co. 3 July 1980 Ceratoides lanata (USU)

326 WY. Lincoln Co. 21 August 1980 Artemisia spp. (USU)

327 WY. Lincoln Co. 24 July 1980 Sarcobatus vermiculatus (USU)

328 WY. Lincoln Co. 13 September 1980 Chrysothamnus nauseosus (USU)

329 WY. Lincoln Co. 24 July 1980 Ceratoides lanata (USU)

330 WY. Lincoln Co. 31 July 1980 Eriogonum spp. (USU)

331 WY. Lincoln Co. 4 August 1980 Artemisia spp. (USU)

332 WY. Lincoln Co. 4 August 1980 Tetradymia canescens (USU)

333 WY. Lincoln Co. 24 June 1980
Sarcobatus vermiculatus (USU)

334 WY. Lincoln Co. 24 June 1980
Chrysothamnus spp. (USU)

335 WY. Lincoln Co. 24 July 1980
Tetradymia canescens (USU)

336 WY. Lincoln Co. 24 June 1980
Artemisia spp. (USU)

337 WY. Lincoln Co. 17 July 1980
Ceratoides lanata (USU)

338 WY. Lincoln Co. 13 August 1980
Ceratoides lanata (USU)

339 WY. Lincoln Co. 29 August 1980
Artemisia spp. (USU)

340 WY. Lincoln Co. 17 July 1980
Artemisia tridentata (USU)

341 WY. Lincoln Co. 13 August 1980
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342 WY. Lincoln Co. 31 July 1980
Ceratoides lanata (USU)

343 WY. Lincoln Co. 24 July 1980
Chrysothamnus spp. (USU)

344 WY. Lincoln Co. 24 July 1980
Artemisia spp. (USU)

345 WY. Lincoln Co. 13 August 1980
Sarcobatus vermiculatus (USU)

346 WY. Lincoln Co. 31 July 1980
Tetradymia canescens (USU)

347 WY. Lincoln Co. 21 August 1980
Ceratoides lanata (USU)

348 WY. Lincoln Co. 9 July 1980 Purshia
tridentata (USU)

349 WY. Lincoln Co. 4 August 1980
Eriogonum spp. (USU)

350 WY. Lincoln Co. 24 June 1980
Artemisia tridentata (USU)

351 WY. Lincoln Co. 24 July 1980
Atriplex spp. (USU)

352 WY. Lincoln Co. 17 July 1980
Eriogonum spp. (USU)

353 WY. Lincoln Co. 7 August 1981
Chrysothamnus nauseosus (USU)

354 WY. Lincoln Co. 13 August 1980
Artemisia spp. (USU)

355 WY. Lincoln Co. 21 August 1980
Sarcobatus vermiculatus (USU)

356 WY. Lincoln Co. 29 August 1980
Chrysothamnus nauseosus (USU)

357 WY. Lincoln Co. 9 July 1980
Chrysothamnus spp. (USU)

358 WY. Lincoln Co. 27 May 1980
Ceratoides lanata (USU)

359 WY. Lincoln Co. 13 August 1980
Artemisia tridentata (USU)

360 WY. Lincoln Co. 9 July 1980
Ceratoides lanata (USU)

361 WY. Lincoln Co. 10 June 1980
Chrysothamnus nauseosus (USU)

362 WY. Lincoln Co. 29 August 1980
Artemisia tridentata (USU)

363 WY. Lincoln Co. 3 July 1980
Chrysothamnus spp. (USU)

364 WY. Lincoln Co. 7 August 1980
Chrysothamnus nauseosus (USU)

365 WY. Lincoln Co. 9 July 1980
Artemisia spp. (USU)

366 WY. Lincoln Co. 3 July 1980
Artemisia spp. (USU)

367 WY. Lincoln Co. 10 June 1980
Artemisia spp. (USU)

368 WY. Lincoln Co. 10 June 1980
Juniperus scopulorum (USU)

369 WY. Lincoln Co. 4 August 1980
Sarcobatus vermiculatus (USU)

370 UT. Sanpete Co. 7 September 1979
Artemisia tridentata (USU)

371 WY. Lincoln Co. 12 July 1983
Eriogonum spp. (USU)

372 WY. Lincoln Co. 3 August 1981
Chrysothamnus spp. (USU)

373 WY. Lincoln Co. 4 September 1980
Artemisia spp. (USU)

374 WY. Lincoln Co. 13 July 1983
Lupinus spp. (USU)

375 WY. Lincoln Co. 12 September 1979
Sarcobatus vermiculatus (USU)

376 WY. Lincoln Co. 6 August 1981
Lupinus spp. (USU)

377 WY. Lincoln Co. 2 September 1981
Chrysothamnus spp. (USU)

378 WY. Lincoln Co. 14 August 1981
Chrysothamnus spp. (USU)

379 WY. Lincoln Co. 17 September 1980
Artemisia spp. (USU)

380 WY. Lincoln Co. 2 September 1981
Amelanchier spp. (USU)

381 WY. Lincoln Co. 29 August 1980 Ceratoides lanata (USU)

382 WY. Lincoln Co. 4 August 1980 Chrysothamnus nauseosus (USU)

383 WY. Lincoln Co. 12 September 1979 Rosa spp. (USU)

384 WY. Lincoln Co. 30 April 1981 Artemisia nova (USU)

385 WY. Lincoln Co. 12 September 1979 Atriplex canescens (USU)

386 UT. Uintah Co. 20 May 1976 Chrysothamnus spp. (USU)

387 WY. Lincoln Co. 7 August 1981 Chrysothamnus spp. (USU)

388 UT. Uintah Co. 30 August 1975 Atriplex confertifolia (USU)

389 WY. Lincoln Co. 4 September 1980 Sarcobatus vermiculatus (USU)

390 UT. Uintah Co. 20 May 1975 Ambrosia spp. (USU)

391 WY. Lincoln Co. 27 May 1980 Chrysothamnus nauseosus (USU)

392 WY. Lincoln Co. 14 May 1981 Amelanchier spp. (USU)

393 WY. Lincoln Co. 12 September 1979 Purshia tridentata (USU)

394 WY. Lincoln Co. 80 July 1917 Chrysothamnus nauseosus (USU)

395 WY. Lincoln Co. 14 August 1983 Artemisia nova (USU)

396 WY. Lincoln Co. 6 August 1981 Chrysothamnus nauseosus (USU)

397 WY. Lincoln Co. 4 August 1980 Ceratoides lanata (USU)

398 WY. Lincoln Co. 17 September 1980 Sarcobatus vermiculatus (USU)

399 WY. Lincoln Co. 24 June 1980 Eriogonum spp. (USU)

400 UT. Box Elder Co. 19 May 1975 Artemisia tridentata (USU)

401 UT. Uintah Co. 14 July 1975 Atriplex confertifolia (USU)

402 UT. Sanpete Co. 12 August 1982 Rosa spp. (USU)

403 WY. Lincoln Co. 24 August 1983 Amelanchier spp. (USU)

404 WY. Lincoln Co. 13 July 1983 Artemisia spinosa (USU)

405 WY. Lincoln Co. 13 July 1983 Artemisia spp. (USU)

406 WY. Lincoln Co. 24 August 1983 Symphoricarpos spp. (USU)

407 WY. Lincoln Co. 24 August 1983 Purshia spp. (USU)

408 WY. Lincoln Co. 17 September 1981 Purshia spp. (USU)

409 UT. Sanpete Co. 1 August 1979 Artemisia tridentata (USU)

410 WY. Lincoln Co. 28 May 1981 Artemisia tridentata (USU)

411 WY. Lincoln Co. 22 September 1983 Chrysothamnus spp. (USU)

412 WY. Lincoln Co. 13 July 1983 Sarcobatus spp. (USU)

413 WY. Lincoln Co. 13 July 1983 Artemisia tridentata (USU)

414 WY. Lincoln Co. 24 August 1983 Chrysothamnus spp. (USU)

415 WY. Lincoln Co. 24 August 1983 Chrysothamnus nauseosus (USU)

416 UT. Box Elder Co. 26 April 1974 Artemisia spp. (USU)

417 WY. Lincoln Co. 29 August 1980 Sarcobatus vermiculatus (USU)

418 WY. Lincoln Co. 21 August 1980 Chrysothamnus spp. (USU)

419 WY. Lincoln Co. 29 August 1980 Chrysothamnus spp. (USU)

420 WY. Lincoln Co. 10 June 1980 Artemisia tridentata (USU)

421 WY. Lincoln Co. 28 May 1981 Artemisia spp. (USU)

422 WY. Lincoln Co. 7 September 1983 Chrysothamnus spp. (USU)

423 WY. Lincoln Co. 21 August 1980 Artemisia tridentata (USU)

424 WY. Lincoln Co. 10 June 1980 Chrysothamnus spp. (USU)

425 WY. Lincoln Co. 24 July 1980 Artemisia tridentata (USU)

426 WY. Lincoln Co. 31 July 1980 Chrysothamnus spp. (USU)

427 WY. Lincoln Co. 13 July 1983 Juniperus spp. (USU)

428 WY. Lincoln Co. 17 July 1980 Chrysothamnus spp. (USU)

429 WY. Lincoln Co. 17 September 1980 Artemisia tridentata (USU)

430 WY. Lincoln Co. 13 July 1983 Amelanchier spp. (USU)

431 WY. Lincoln Co. 31 July 1980 Artemisia tridentata (USU)

432 WY. Lincoln Co. 6 August 1981 Chrysothamnus spp. (USU)

433 WY. Lincoln Co. 12 July 1983 Juniperus spp. (USU)

434 WY. Lincoln Co. 17 July 1980 Juniperus scopulorum (USU)

435 WY. Lincoln Co. 4 August 1980 Chrysothamnus spp. (USU)

436 WY. Lincoln Co. 27 May 1980 Sarcobatus vermiculatus (USU)

437 WY. Lincoln Co. 4 August 1980 Artemisia tridentata (USU)

438 WY. Lincoln Co. 31 July 1980 Juniperus scopulorum (USU)

439 CO. Weld Co. 6 September 1971 Eriogonum spp. (UW)

440 CO. Weld Co. 7 August 1971 Eriogonum spp. (UW)

441 CO. Weld Co. 17 August 1971 Gutierrezia spp. (UW)

442 CO. Weld Co. 25 August 1971 Salix interior (UW)

443 CO. Weld Co. 6 September 1971 Chrysothamnus spp. (UW)

444 CO. Weld Co. 17 August 1971 Eriogonum spp. (UW)

445 CO. Weld Co. 14 August 1972 Gutierrezia sarothrae (UW)

446 CO. Weld Co. 21 September 1972 Chrysothamnus nauseosus (UW)

447 CO. Weld Co. 6 September 1971 Eriogonum effusum (UW)

448 CO. Weld Co. 6 September 1971 Gutierrezia spp. (UW)

449 CO. Weld Co. 21 September 1972 Chrysothamnus nauseosus (UW)

450 CO. Weld Co. 7 September 1972 Chrysothamnus nauseosus (UW)

451 CO. Weld Co. 7 September 1972 Gutierrezia sarothrae (UW)

452 CO. Weld Co. 13 September 1972 Gutierrezia sarothrae (UW)

453 CO. Weld Co. 20 September 1971 Gutierrezia sarothrae (UW)

454 CO. Weld Co. 22 September 1971 Artemisia frigida (UW)

455 CO. Weld Co. 20 July 1971 Eriogonum effusum (UW)

456 CO. Weld Co. 21 July 1971 Chrysothamnus nauseosus (UW)

457 CO. Weld Co. 17 August 1971 Chrysothamnus spp. (UW)

458 CO. Weld Co. 3 August 1971 Gutierrezia sarothrae (UW)

459 CO. Weld Co. 17 August 1971 Gutierrezia sarothrae (UW)

460 CO. Weld Co. 20 September 1972 Gutierrezia sarothrae (UW)

461 CO. Weld Co. 15 April 1971 Opuntia spp. (UW)

462 CO. Weld Co. 17 August 1971 Artemisia frigida (UW)

463 CO. Weld Co. 7 August 1972 Gutierrezia sarothrae (UW)

464 CO. Weld Co. 19 August 1971 Gutierrezia spp. (UW)

465 CO. Weld Co. 5 September 1971 Gutierrezia sarothrae (UW)

466 CO. Weld Co. 27 August 1971 Gutierrezia sarothrae (UW)

467 CO. Weld Co. 24 August 1971 Gutierrezia sarothrae (UW)

468 CO. Weld Co. 22 October 1971 Artemisia frigida (UW)

469 CO. Weld Co. 13 September 1972 Chrysothamnus nauseosus (UW)

470 CO. Weld Co. 7 August 1972 Chrysothamnus nauseosus (UW)

471 CO. Weld Co. 15 April 1971 Atriplex spp. (UW)

472 CO. Weld Co. 5 September 1971 Eriogonum effusum (UW)

473 CO. Weld Co. 24 July 1971 Gutierrezia spp. (UW)

474 CO. Weld Co. 7 August 1972 Chrysothamnus spp. (UW)

475 CO. Weld Co. 20 August 1971 Eriogonum spp. (UW)

476 CO. Weld Co. 10 August 1971 Yucca glauca (=Y. kanabensis) (UW)

477 CO. Weld Co. 1 June 1972 Eriogonum spp. (UW)

478 CO. Weld Co. 22 August 1972 Eriogonum effusum (UW)

479 CO. Weld Co. 13 September 1972 Gutierrezia spp. (UW)

480 CO. Weld Co. 15 April 1971 Atriplex canescens (UW)

481 CO. Weld Co. 6 June 1971 Artemisia frigida (UW)

482 CO. Weld Co. 25 October 1971 Artemisia spp. (UW)

483 CO. Weld Co. 25 August 1971 Gutierrezia sarothrae (UW)

484 CO. Weld Co. 22 October 1971 Gutierrezia sarothrae (UW)

485 CO. Weld Co. 28 June 1976 Salix exigua (UW)

486 CO. Weld Co. 23 June 1975 Coryphantha vivipara (UW)

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Artemisia spinosa [628] 3 404
Artemisia spp. [54] 10 18 68 101 150 189 191 210 263 265 266 288 306 315 323 326 331 336 339 344 354 365 366 367 373 379 405 416 421 482
Artemisia tridentata [63] 1 9 28 36 67 86 88 98 105 108 111 114 120 123 126 143 152 163 166 170 173 181 188 192 199 208 211 222 226 228 236 239 240 243 249 251 253 258 260 262 280 281 299 300 303 313 314 319 340 350 359 362 370 400 409 410 413 420 423 425 429 431 437
Artemisia tridentata tridentata [64] 15
Atriplex canescens [83] 58 77 141 159 176 241 385 480
Atriplex confertifolia [84] 56 97 107 112 117 118 121 128 138 151 161 165 168 179 193 194 198 209 213 214 217 221 224 229 234 237 255 285 293 297 388 401
Atriplex spp. [79] 35 49 61 85 115 148 351 471
Ceratoides lanata [163] 312 325 329 337 338 342 347 358 360 381 397
Chrysothamnus nauseosus [181] 6 21 32 34 40 42 43 53 62 81 92 100 129 133 139 156 175 182 185 201 205 219 231 233 235 250 279 307 321 322 324 328 341 353 356 361 364 382 391 394 396 415 446 449 450 456 469 470
Chrysothamnus spp. [592] 11 19 54 59 73 76 125 149 160 172 184 196 244 261 334 343 357 363 372 377 378 386 387 411 414 418 419 422 424 426 428 432 435 443 457 474
Chrysothamnus viscidiflorus [191] 5 22 55 60 74 91 96 106 109 110 113 116 119 122 124 136 153 154 162 164 169 180 195 197 200 207 212 215 216 223 225 227 238 252 254 259 268 284 290 298 301 302 318
Clematis ligusticifolia [197] 31 37 41 71 102 132 291
Coryphantha vivipara [217] 486
Cowania spp. [218] 296
Eriogonum effusum [635] 447 455 472 478
Eriogonum spp. [250] 27 90 99 135 183 204 218 242 320 330 349 352 371 399 439 440 444 475 477
Gutierrezia sarothrae [285] 26 83 187 445 451 452 453 458 459 460 463 465 466 467 483 484
Gutierrezia spp. [283] 441 448 464 473 479
Holodiscus discolor [289] 177
Juniperus scopulorum [923] 308 311 316 368 434 438
Juniperus spp. [309] 64 271 272 273 274 275 276 277 282 427 433
Lupinus spp. [684] 374 376
Opuntia spp. [360] 295 461
Prunus virginiana [415] 305
Purshia spp. [425] 13 407 408
Purshia tridentata [427] 256 257 348 393
Rhus ovata [453] 38 72 87 130 287
Rhus trilobata [455] 80 95 147
Ribes aureum [458] 292 294
Rosa spp. [475] 383 402
Rubus spp. [481] 270
Salix exigua [496] 93 142 157 202 485
Salix interior [612] 442
Salix spp. [491] 24 46 52 65 70 82 94 131 144 158 203
Sarcobatus spp. [594] 7 17 44 178 412
Sarcobatus vermiculatus [586] 2 23 47 48 57 89 137 171 186 246 283 286 304 327 333 345 355 369 375 389 398 417 436
Symphoricarpos spp. [534] 14 267 310 406
Tamarix gallica [807] 25 33 69 84 103 140 155 167 230 232 247
Tamarix spp. [787] 30 63 104 134 146 206
Tetradymia canescens [617] 51 66 75 245 248 264 332 335 346
Tetradymia spp. [548] 78
Yucca glauca (=Y. kanabensis) [583] 476
Yucca spp. [577] 269

SECTION III: INSECT INFORMATION

Insect Listing

This listing contains insect information. See "Description of the Sections" for details about the information included in the listing. Items in the listing are organized numerically and are located using one of the six indexes that follow in this section, except the "Insect Order to Family Index," which is used only by the "Insect Family Listing."

1 (Not examined, insect species undetermined)

2 Aptinothrips rufus (Gmelin) [Thysanoptera: Thripidae] Immature/Adult Guild: Flower feeder/Flower feeder

3 Frankliniella spp. [Thysanoptera: Thripidae]

4 Sericothrips spp. [Thysanoptera: Thripidae]

5 Orius tristicolor (White) [Hemiptera: Anthocoridae] Immature/Adult Guild: Predator/Predator

6 Lygus spp. [Hemiptera: Miridae] Immature/Adult Guild: Bud,seed feeder/Bud,seed feeder

7 Geocoris spp. (Big-eyed bug) [Hemiptera: Lygaeidae] Immature/Adult Guild: Predator/Predator

8 Pitedia sayei [Hemiptera: Pentatomidae]

9 Chrysopa spp. [Neuroptera: Chrysopidae] Immature/Adult Guild: Predator/?

10 Amecocerus spp. [Coleoptera: Dasytidae]

11 Nabis spp. (Damsel bugs) [Hemiptera: Nabidae] Immature/Adult Guild: Predator/Predator

12 Thyanta spp. [Hemiptera: Pentatomidae]

13 Monoxia consputa LeConte (Western beet leaf beetle) [Coleoptera: Chrysomelidae]

14 Cardiophorus pullus Pl. [Coleoptera: Elateridae]

15 Anaphothrips obscurus (Mueller) (Grass thrips) [Thysanoptera: Thripidae]

16 Frankliniella moultoni Hood [Thysanoptera: Thripidae]

17 Frankliniella tritici (Fitch) (Wheat thrips or flower thrips) [Thysanoptera: Thripidae]

18 Haplothrips mali (Fitch) [Thysanoptera: Phlaeothripidae] Immature/Adult Guild: Fruit feeder/Fruit feeder

19 Aeolothrips fasciatus (Linnaeus) [Thysanoptera: Aeolothripidae] Immature/Adult Guild: Predator/Predator

20 Odontothrips lati (Haliday) [Thysanoptera: Thripidae]

21 Thrips abdominalis (Crawford) [Thysanoptera: Thripidae]

22 Sericothrips chrysothamni Hodd [Thysanoptera: Thripidae]

23 Lygus desertinus Knight [Hemiptera: Miridae]

24 Lygus hesperus Knight [Hemiptera: Miridae] Immature/Adult Guild: Leaf,stem feeder/Leaf,stem feeder

25 Nabis alternatus (Parshley) [Hemiptera: Nabidae]

26 Geocoris atricolor (Big-eyed bug) [Hemiptera: Lygaeidae] Immature/Adult Guild: Predator/Predator

27 Xerophloea viridis (Fabricius) (Green flat-headed leafhopper) [Homoptera: Cicadellidae]

28 Calops descretus [Coleoptera: Chrysomelidae]

29 Psylliodes punctulata Melscheimer (Hop flea beetle) [Coleoptera: Chrysomelidae]

30 Mecas bicallosa Martin [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

31 Bombus fervidus (Fabricius) (Yellow bumblebee) [Hymenoptera: Apidae]

32 Apis mellifera Linnaeus (Honey bee) [Hymenoptera: Apidae] Immature/Adult Guild: ?/Nectar,pollen feeder

33 Malacosoma californicum (Packard) (California tent caterpillar) [Lepidoptera: Lasiocampidae] Immature/Adult Guild: Leaf feeder/?

34 Lycophotia margaritosa (Haworth) (Variegated cutworm) [Lepidoptera: Noctuidae] Immature/Adult Guild: Leaf feeder/?

35 Anacamptodes clivinaria profanata (Barnes & McDunnough) (Mountain mahogany looper) [Lepidoptera: Geometridae] Immature/Adult Guild: Leaf feeder/? Overwintering Stage: Pupae Generations Per Year: 1

36 Mayetiola spp. (=Phytophaga) (Bitterbrush seed midges) [Diptera: Cecidomyiidae] Immature/Adult Guild: Internal seed feeder/?

37 Hemerocampa vetusta gulosa (=Orgyia) Boisduvall (Western tussock moth) [Lepidoptera: Liparidae] Immature/Adult Guild: Fruit,leaf feeder/?

38 Chlorochroa sayi Stal (Say stinkbug) [Hemiptera: Pentatomidae] Immature/Adult Guild: Bud,seed feeder/Bud,seed feeder

39 Filatima sperryi Clarke (Dark bitterbrush leaf tier) [Lepidoptera: Tortricidae] Immature/Adult Guild: Internal seed feeder/?

40 Gelechia mandella Busck (White-collared leaf tier) [Lepidoptera: Gelechiidae] Immature/Adult Guild: Internal seed feeder/?

41 Frankliniella occidentalis (Pergande) (Western flower thrips) [Thysanoptera: Thripidae] Immature/Adult Guild: Bud,flower,leaf feeder/Bud,flower,leaf feeder

42 Frankliniella minuta (Moulton) (Small thrips) [Thysanoptera: Thripidae]

43 Leptothrips spp. [Thysanoptera: Phlaeothripidae]

44 Thrips tabaci Lindeman (Tobacco or onion thrips) [Thysanoptera: Thripidae]

45 Aeolothrips duvali [Thysanoptera: Aeolothripidae]

46 Aeolothrips fuscus [Thysanoptera: Aeolothripidae]

47 Halictus farinosus Smith [Hymenoptera: Halictidae]

48 Hymenorus densus LeConte [Coleoptera: Alleculidae]

49 Tricorynus gibbulum (Fall) [Coleoptera: Anobiidae]

50 Xyletinus nr. lugubris LeConte [Coleoptera: Anobiidae]

51 Anthicus nr. scabriceps LeConte [Coleoptera: Anthicidae]

52 Ischyropalpus spp. [Coleoptera: Anthicidae]

53 Notoxus spp. [Coleoptera: Anthicidae]

54 Trigonorhinus limbatus (Say) [Coleoptera: Anthribidae]

55 Trigonorhinus spp. [Coleoptera: Anthribidae]

56 Acanthoscelides aequalis (Sharp) [Coleoptera: Bruchidae]

57 Acanthoscelides compressicornis (Schaeffer) [Coleoptera: Bruchidae]

58 Acanthoscelides obrienorum Johnson [Coleoptera: Bruchidae]

59 Acanthoscelides schrankiae (Horn) [Coleoptera: Bruchidae]

60 Algarobius prosopis (LeConte) [Coleoptera: Bruchidae]

61 Merobruchus julianus (Horn) [Coleoptera: Bruchidae]

62 Mimosestes amicus (Horn) [Coleoptera: Bruchidae]

63 Mimosestes protractus (Horn) [Coleoptera: Bruchidae]

64 Sennius morosus (Sharp) [Coleoptera: Bruchidae]

65 Stator limbatus (Horn) [Coleoptera: Bruchidae]

66 Stator pruininus (Horn) [Coleoptera: Bruchidae]

67 Zabrotes spectabilis Horn [Coleoptera: Bruchidae]

68 Acmaeodera scalaris Mann. [Coleoptera: Buprestidae] Oviposition Medium: Bark surfaces

69 Agrilus gibbicollis Fall [Coleoptera: Buprestidae] Oviposition Medium: Bark surfaces

70 Chauliognathus discus LeConte [Coleoptera: Cantharidae]

71 Chauliognathus marginatus Fabricius [Coleoptera: Cantharidae]

72 Chauliognathus scutellaris LeConte [Coleoptera: Cantharidae]

73 Trypherus spp. [Coleoptera: Cantharidae]

74 Philophuga viridis Dej. [Coleoptera: Carabidae]

75 Crossidius discoideus (Say) [Coleoptera: Cerambycidae]

76 Crossidius pulchellus LeConte [Coleoptera: Cerambycidae] Immature/Adult Guild: Root,stem borer/Nectar,petal,pollen feeder

77 Placosternus difficilis (Chev.) [Coleoptera: Cerambycidae]

78 Altica foliacea LeConte [Coleoptera: Chrysomelidae] Immature/Adult Guild: Skeletonizer/Leaf perforator

79 Babia tetraspilota LeConte [Coleoptera: Chrysomelidae]

80 Chaetocnema pulicaria Melsh. [Coleoptera: Chrysomelidae]

81 Chlamisus nr. foveolatus (Knoch) [Coleoptera: Chrysomelidae]

82 Colaspoides spp. [Coleoptera: Chrysomelidae]

83 Coscinoptera mucorea (LeConte) [Coleoptera: Chrysomelidae]

84 Cryptocephalus amatus Hald. [Coleoptera: Chrysomelidae]

85 Chryptocephalus brunneovittatus Schaeffer [Coleoptera: Chrysomelidae]

86 Cryptocephalus cerinus cerinus White [Coleoptera: Chrysomelidae]

87 Cryptocephalus confluens Say [Coleoptera: Chrysomelidae]

88 Cryptocephalus spp. [Coleoptera: Chrysomelidae]

89 Diabrotica longicornis longicornis (Say) [Coleoptera: Chrysomelidae]

90 Diabrotica tricincta (Say) (Three-banded diabrotica) [Coleoptera: Chrysomelidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

91 Diabrotica undecimpunctata howardi Barber [Coleoptera: Chrysomelidae]

92 Diachus auratus (Fabricius) (Bronze willow flea beetle) [Coleoptera: Chrysomelidae] Immature/Adult Guild: Leaf feeder/Flower,leaf feeder

93 Distigmoptera apicalis Blake [Coleoptera: Chrysomelidae]

94 Epitrix nr. hirtipennis (Melsh.) [Coleoptera: Chrysomelidae]

95 Euryscopa pilatei Lac. [Coleoptera: Chrysomelidae]

96 Exema mormana Karren [Coleoptera: Chrysomelidae]

97 Gastrophysa dissimilis (Say) [Coleoptera: Chrysomelidae]

98 Glyptina cerina (LeConte) [Coleoptera: Chrysomelidae]

99 Glyptina spuria LeConte [Coleoptera: Chrysomelidae]

100 Monoxia apicalis Blake [Coleoptera: Chrysomelidae]

101 Monoxia puberula Blake [Coleoptera: Chrysomelidae]

102 Pachybrachis nero Bowditch [Coleoptera: Chrysomelidae]

103 Conoderus vespertinus (Fabricius) [Coleoptera: Elateridae]

104 Megapenthes spp. [Coleoptera: Elateridae]

105 Melanophthalmus spp. [Coleoptera: Lathridiidae]

106 Epicauta ferruginea (Say) [Coleoptera: Meloidae]

107 Zonitis atripennis (Say) [Coleoptera: Meloidae]

108 Amphivectura spp. [Coleoptera: Melyridae]

109 Attalus lecontei Champ. [Coleoptera: Melyridae]

110 Collops balteatus LeConte [Coleoptera: Melyridae]

111 Collops confluens LeConte [Coleoptera: Melyridae]

112 Collops limbellus G. & H. [Coleoptera: Melyridae]

113 Collops punctatus LeConte [Coleoptera: Melyridae]

114 Collops quadrimaculatus (Fabricius) [Coleoptera: Melyridae]

115 Collops vittatus (Say) (Striped collops) [Coleoptera: Melyridae] Immature/Adult Guild: Predator/Predator

116 Hypebaeus spp. [Coleoptera: Melyridae]

117 Trichochrous spp. [Coleoptera: Melyridae]

118 Diclidia spp. [Coleoptera: Mordellidae]

119 Mordella melaena Germar [Coleoptera: Mordellidae]

120 Mordellistena spp. [Coleoptera: Mordellidae]

121 Eurygenius spp. [Coleoptera: Pedilidae]

122 Olibrus spp. [Coleoptera: Phalacridae]

123 Phalacrus spp. [Coleoptera: Phalacridae]

124 [Record Deleted]

125 Cotinis mutabilis (G. & P.) [Coleoptera: Scarabaeidae]

126 Diplotaxis subangulata LeConte [Coleoptera: Scarabaeidae]

127 Dendrocranulus spp. (LeConte) [Coleoptera: Scolytidae]

128 Bothrotes canaliculatus acutus LeConte [Coleoptera: Tenebrionidae]

129 Bothrotes plumbeus plumbeus (LeConte) [Coleoptera: Tenebrionidae]

130 Bothrotes spp. [Coleoptera: Tenebrionidae]

131 Eleodes extricata (Say) [Coleoptera: Tenebrionidae]

132 Eleodes fusiformis LeConte [Coleoptera: Tenebrionidae]

133 Eleodes obsoleta (Say) [Coleoptera: Tenebrionidae]

134 Eleodes tricostata (Say) [Coleoptera: Tenebrionidae]

135 Eusattus reticulatus (Say) [Coleoptera: Tenebrionidae]

136 Metoponium nr. cognitum Casey [Coleoptera: Tenebrionidae]

137 Steriphanus spp. [Coleoptera: Tenebrionidae]

138 Sminthurus sylvestris Banks [Collembola: Sminthuridae]

139 Hylemya spp. [Diptera: Anthomyiidae]

140 Dilophus spp. [Diptera: Bibionidae]

141 Cochliomyia macellaria (Fabricius) (Screw worm) [Diptera: Calliphoridae] Immature/Adult Guild: Endoparasite/?

142 Asphondylia spp. [Diptera: Cecidomyiidae]

143 Rhopalomyia spp. [Diptera: Cecidomyiidae]

144 Leucopis spp. [Diptera: Chamaemyiidae]

145 Chlorops 5-punctatus Loew [Diptera: Chloropidae]

146 Chlorops spp. [Diptera: Chloropidae]

147 Conioscinella nuda (Adams) [Diptera: Chloropidae]

148 Meromyza spp. [Diptera: Chloropidae]

149 Neodiplotoxa pulchripes (Loew) [Diptera: Chloropidae]

150 Opetiophora straminea Loew [Diptera: Chloropidae]

151 Siphonella nigripalpis (Mall.) [Diptera: Chloropidae]

152 Thaumatomyia glabra (Meigen) [Diptera: Chloropidae]

153 Paralimna punctipennis (Wied.) [Diptera: Ephydridae]

154 Camptoprosopella inaequalis Shewell [Diptera: Lauxaniidae]

155 Tritoxa cuneata Loew [Diptera: Otitidae]

156 Blaesoxipha spp. [Diptera: Sarcophagidae]

157 Ravinia derelicta (Walker) [Diptera: Sarcophagidae]

158 Ravinia lherminieri (Robineau & Desvoidy) [Diptera: Sarcophagidae]

159 Ravinia planifrons (Aldrich) [Diptera: Sarcophagidae]

160 Senotainia rubriventris Macq. [Diptera: Sarcophagidae]

161 Sepsis neocynipsea Melander & Spuler [Diptera: Sepsidae]

162 Eulalia spp. [Diptera: Stratiomyidae]

163 Nemotelus spp. [Diptera: Stratiomyidae]

164 Allograpta exotica (Wied.) [Diptera: Syrphidae] Immature/Adult Guild: Predator/Nectar feeder

165 Toxomerus marginatus (Say) [Diptera: Syrphidae]

166 Leucostoma spp. [Diptera: Tachinidae]

167 Microchaetina spp. [Diptera: Tachinidae]

168 Paradidyma spp. [Diptera: Tachinidae]

169 Prosenoides spp. [Diptera: Tachinidae]

170 Schizactia spp. [Diptera: Tachinidae]

171 Siphophyto spp. [Diptera: Tachinidae]

172 Sitophaga spp. [Diptera: Tachinidae]

173 Euarestoides acutangulus Thomson [Diptera: Tephritidae] Immature/Adult Guild: Pollen feeder/? Overwintering Stage: Pupae Oviposition Medium: Flowers Generations Per Year: 2

174 Neaspilota spp. [Diptera: Tephritidae]

175 Trupanea actinobola (Loew) [Diptera: Tephritidae]

176 Trupanea signata Foote [Diptera: Tephritidae]

177 Psilocephala spp. [Diptera: Therevidae]

178 Xyonysius californicus (Stal) [Hemiptera: Lygaeidae]

179 Coquillettia mimetica Osborn [Hemiptera: Miridae]

180 Mecidea major Sailer [Hemiptera: Pentatomidae]

181 Liorhyssus hyalinus (Fabricius) [Hemiptera: Rhopalidae] Immature/Adult Guild: Leaf,stem feeder/Leaf,stem feeder

182 Corythucha morrilli Osborn & Drake [Hemiptera: Tingidae] Immature/Adult Guild: Leaf,stem feeder/Leaf,stem feeder

183 Acanalonia invenusta Doering [Homoptera: Acanaloniidae]

184 Acanalonia parva Doering [Homoptera: Acanaloniidae]

185 Aphis gutierrezis (Pack & Knowlton) [Homoptera: Aphididae]

186 Dactynotus zerogutierreziae (Smith & Knowlton) [Homoptera: Aphididae]

187 Clastoptera lineatocollis Stal [Homoptera: Cercopidae]

188 Cerococcus artemisiae (Cockerell) [Homoptera: Asterolecaniidae]

189 Aceratagallia sanguinolenta (Provancher) (Clover leafhopper) [Homoptera: Cicadellidae] Immature/Adult Guild: Sap feeder/Sap feeder

190 Aceratagallia uhleri (Van Duzee) (Uhler's leafhopper) [Homoptera: Cicadellidae] Immature/Adult Guild: Sap feeder/Sap feeder

191 Acinopterus bakeri Lawson [Homoptera: Cicadellidae]

192 Athysanella argenteola (Uhler) [Homoptera: Cicadellidae]

193 Athysanella clavata Ball & Beamer [Homoptera: Cicadellidae]

194 Balclutha guajanae (DeLong) [Homoptera: Cicadellidae]

195 Balclutha neglecta (DeLong & Davidson) [Homoptera: Cicadellidae]

196 Balclutha spp. [Homoptera: Cicadellidae]

197 Ceratagallia bigeloviae (Baker) [Homoptera: Cicadellidae]

198 Chlorotettix spatulatus Osborn & Ball [Homoptera: Cicadellidae]

199 Chlorotettix spp. [Homoptera: Cicadellidae]

200 Ciminius sidanus (Ball) [Homoptera: Cicadellidae]

201 Cuerna arida Oman & Beamer [Homoptera: Cicadellidae]

202 Cuerna costalis (Fabricius) [Homoptera: Cicadellidae]

203 Cuerna obesa Oman & Beamer [Homoptera: Cicadellidae]

204 Cuerna striata (Walker) [Homoptera: Cicadellidae]

205 Driotura vittata Ball [Homoptera: Cicadellidae]

206 Driotura vittata nigra Lawson [Homoptera: Cicadellidae]

207 Empoasca alboneura Gillette [Homoptera: Cicadellidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

208 Empoasca mexicana Gillette [Homoptera: Cicadellidae]

209 Exitianus exitiosus (Uhler) [Homoptera: Cicadellidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

210 Flexamia abbreviata (Osborn & Ball) [Homoptera: Cicadellidae]

211 Flexamia flexulosa (Ball) [Homoptera: Cicadellidae]

212 Gillettiella labiata (Gillette) [Homoptera: Cicadellidae]

213 Graminella sonora (Ball) [Homoptera: Cicadellidae]

214 Graphocephala marathonensis (Olsen) [Homoptera: Cicadellidae]

215 Gyponana delta Ball [Homoptera: Cicadellidae]

216 Keonolla dolobrata (Ball) [Homoptera: Cicadellidae]

217 Norvellina pulchella (Baker) [Homoptera: Cicadellidae]

218 Opsius stactogalus Fieber [Homoptera: Cicadellidae]

219 Polyamia spp. [Homoptera: Cicadellidae]

220 Psammotettix spp. [Homoptera: Cicadellidae]

221 Scaphytopius irroratus (Van Duzee) [Homoptera: Cicadellidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

222 Stirellus bicolor (Van Duzee) [Homoptera: Cicadellidae]

223 Stragania bisignata Ball [Homoptera: Cicadellidae]

224 Stragania robusta (Uhler) [Homoptera: Cicadellidae]

225 Texananus latipex DeLong [Homoptera: Cicadellidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

226 Tinobregmus vittatus Van Duzee [Homoptera: Cicadellidae]

227 Xerophloea peltata (Uhler) [Homoptera: Cicadellidae] Immature/Adult Guild: Leaf,stem feeder/Leaf,stem feeder

228 Cixius spp. [Homoptera: Cixiidae]

229 Oecleus nolinus Ball & Klingenberg [Homoptera: Cixiidae]

230 Oliarus spp. [Homoptera: Cixiidae]

231 Bostaera nasuta [Homoptera: Delphacidae]

232 Scolops grossus Uhler [Homoptera: Dictyopharidae]

233 Scolops pungens (Germar) [Homoptera: Dictyopharidae]

234 Eriococcus cryptus [Homoptera: Eriococcidae]

235 Eriococcus spp. [Homoptera: Eriococcidae]

236 Mistharnophantia sonorana Kirkaldy [Homoptera: Flatidae]

237 Fitchiella rufipes Lawson [Homoptera: Issidae]

238 Hysteropterum sepulchralis Ball [Homoptera: Issidae]

239 Tachardiella glomerella (Cockerell) [Homoptera: Lacciferidae]

240 Oeclidius nanus Van Duzee [Homoptera: Kinnaridae]

241 Steatococcus townsendi (Cockerell) [Homoptera: Margarodidae]

242 Micrutalis calva (Fitch) [Homoptera: Membracidae]

243 Spissistilus festinus (Say) [Homoptera: Membracidae] Immature/Adult Guild: Stem feeder/Stem feeder

244 Stictopelta marmorata Goding [Homoptera: Membracidae]

245 Vanduzea laeta Goding [Homoptera: Membracidae]

246 Chorizococcus spp. [Homoptera: Pseudococcidae]

247 Phenacoccus gossypii Town. & Ckll. [Homoptera: Pseudococcidae] Immature/Adult Guild: Stem feeder/Stem feeder

248 Phenacoccus helianthi (Cockerell) [Homoptera: Pseudococcidae]

249 Spilococcus spp. [Homoptera: Pseudococcidae]

250 Craspedolepta gutierreziae (Klyver) [Homoptera: Psyllidae]

251 Heteropsylla texana Crawford [Homoptera: Psyllidae]

252 Kuwayama medicaginis Crawford (Alfalfa psyllid) [Homoptera: Psyllidae]

253 Rhinopsylla dimorpha Caldwell [Homoptera: Psyllidae]

254 Trioza diospyri Ashmead [Homoptera: Psyllidae]

255 Perdita ignota Cockerell [Hymenoptera: Andrenidae]

256 Perdita nr. lacteipennis Swenk. & Ckll. [Hymenoptera: Andrenidae]

257 Perdita nr. stottleri Cockerell [Hymenoptera: Andrenidae]

258 Pseudopanurgus spp. [Hymenoptera: Andrenidae]

259 Exomalopsis spp. [Hymenoptera: Anthophoridae]

260 Melissodes nr. verbesinarum Cockerell [Hymenoptera: Anthophoridae]

261 Bombus sonorus Say [Hymenoptera: Apidae]

262 Schizocerella pilicornis (Holmgren) [Hymenoptera: Argidae]

263 Holepyris spp. [Hymenoptera: Bethylidae]

264 Parasierola spp. [Hymenoptera: Bethylidae]

265 Hyaleus spp. [Hymenoptera: Colletidae]

266 Alloxysta spp. [Hymenoptera: Cynipidae]

267 Melanips spp. [Hymenoptera: Figitidae]

268 Camponotus vicinus Mayr [Hymenoptera: Formicidae]

269 Conomyrma insana (Buckley) [Hymenoptera: Formicidae]

270 Crematogaster punctulata Emery [Hymenoptera: Formicidae] Immature/Adult Guild: ?/Aphid farmer

271 Forelius foetidus (Buckley) [Hymenoptera: Formicidae]

272 Iridomyrmex pruinosus Roger [Hymenoptera: Formicidae]

273 Leptothorax pergandei Emery [Hymenoptera: Formicidae]

274 Monomorium minimum (Buckley) (Minute black ant) [Hymenoptera: Formicidae]

275 Myrmecocystus depilis Forel [Hymenoptera: Formicidae]

276 Myrmecocystus mimicus Wheeler [Hymenoptera: Formicidae]

277 Novomessor cockerelli Andre [Hymenoptera: Formicidae]

278 Paratrechina spp. [Hymenoptera: Formicidae]

279 Pheidole spp. [Hymenoptera: Formicidae]

280 Pogonomyrmex rugosus Emery [Hymenoptera: Formicidae]

281 Solenopsis aurea Wheeler [Hymenoptera: Formicidae]

282 Solenopsis xyloni McCook [Hymenoptera: Formicidae]

283 Agapostemon texanus Cresson [Hymenoptera: Halictidae]

284 Dialictus clematisellus (Cockerell) [Hymenoptera: Halictidae]

285 Dialictus nr. hunteri (Crawford) [Hymenoptera: Halictidae]

286 Dialictus spp. [Hymenoptera: Halictidae]

287 Halictus tripartitus Cockerell [Hymenoptera: Halictidae]

288 Ashmeadiella bucconis (Say) [Hymenoptera: Megachilidae]

289 Megachile texana Cresson [Hymenoptera: Megachilidae]

290 Pseudomethoca spp. [Hymenoptera: Mutillidae]

291 Anoplius spp. [Hymenoptera: Pompilidae]

292 Episyron snowi (Viereck) [Hymenoptera: Pompilidae]

293 Psorthaspis macronotum cressoni Bladley [Hymenoptera: Pompilidae]

294 Cerceris spp. [Hymenoptera: Sphecidae]

295 Oxybelus spp. [Hymenoptera: Sphecidae]

296 Paratiphia mitchelli Allen [Hymenoptera: Tiphiidae]

297 Cisthene tenuifascia (Harv.) [Lepidoptera: Arctiidae]

298 Eubaphe unicolor (Robinson) [Lepidoptera: Geometridae]

299 Melanochroia chephise (Cram.) [Lepidoptera: Geometridae]

300 Pergama radiosaria (Hulst) [Lepidoptera: Geometridae]

301 Tornos scolopacinarius (Gn.) [Lepidoptera: Geometridae]

302 Acontia spp. [Lepidoptera: Noctuidae]

303 Spragueia jaguaralis Hmpsn. [Lepidoptera: Noctuidae]

304 Carmenta prosopis (Edw.) [Lepidoptera: Sesiidae]

305 Synnoma lynosyrana Walsingham (Rabbitbrush webbing moth) [Lepidoptera: Tortricidae] Immature/Adult Guild: Leaf feeder/?

306 Atteva punctella (Cramer) [Lepidoptera: Yponomeutidae]

307 Micromus subanticus (Walk.) [Neuroptera: Hemerobiidae]

308 Chrysopa carnea Steph. (Common green lacewing) [Neuroptera: Chrysopidae] Immature/Adult Guild: Predator/?

309 Mantispa sayi Bks. [Neuroptera: Mantispidae]

310 Pachybrachis vau Fall [Coleoptera: Chrysomelidae]

311 Pachybrachys spp. (=Pachybrachis spp.) [Coleoptera: Chrysomelidae]

312 Phyllotreta spp. [Coleoptera: Chrysomelidae]

313 Saxinis knausi Schaeffer [Coleoptera: Chrysomelidae]

314 Saxinis spp. [Coleoptera: Chrysomelidae]

315 Systena blanda (Melsh.) (Banded flea beetle) [Coleoptera: Chrysomelidae]

316 Zygogramma disrupta Rogers [Coleoptera: Chrysomelidae]

317 Enoclerus laetus (Klug) [Coleoptera: Cleridae]

318 Enoclerus coccineus (Schenk.) [Coleoptera: Cleridae]

319 Phyllobaenus discoideus (LeConte) [Coleoptera: Cleridae]

320 Anovia virginalis (Wickham) [Coleoptera: Coccinellidae]

321 Diomus debilis (LeConte) [Coleoptera: Coccinellidae]

322 Hippodamia convergens Guerin & Meneville (Convergent ladybird beetle) [Coleoptera: Coccinellidae] Immature/Adult Guild: Predator/Predator

323 Hyperaspidius comparatus Casey [Coleoptera: Coccinellidae]

324 Hyperaspidius insignis Casey [Coleoptera: Coccinellidae]

325 Hyperaspis fimbriolata (Melsh.) [Coleoptera: Coccinellidae]

326 Hyperaspis lateralis Mulsant (Lateral ladybird beetle) [Coleoptera: Coccinellidae] Immature/Adult Guild: Predator/Predator

327 Olla abdominalis (Say) (Ash-gray or eyed ladybird beetle) [Coleoptera: Coccinellidae]

328 Psyllobora renifer (Casey) [Coleoptera: Coccinellidae]

329 Nephus intrusus Horn [Coleoptera: Coccinellidae]

330 Scymnus ardelio Horn [Coleoptera: Coccinellidae]

331 Scymnus creperus Muls. [Coleoptera: Coccinellidae]

332 Scymnus horni Gorham [Coleoptera: Coccinellidae]

333 Scymnus loewii Muls. [Coleoptera: Coccinellidae]

334 Scymnus pallens LeConte [Coleoptera: Coccinellidae]

335 Zagloba hystrix Casey [Coleoptera: Coccinellidae]

336 Anthonomus decipiens LeConte [Coleoptera: Curculionidae]

337 Anthonomus nr. decipiens LeConte [Coleoptera: Curculionidae]

338 Anthonomus tenuis Fall [Coleoptera: Curculionidae]

339 Apion amaurum Kissinger [Coleoptera: Curculionidae]

340 Apion impunctistriatum Smith [Coleoptera: Curculionidae]

341 Apion spp. [Coleoptera: Curculionidae] Immature/Adult Guild: ?/Leaf feeder

342 Centrinaspis spp. [Coleoptera: Curculionidae]

343 Cylindrocopturus spp. [Coleoptera: Curculionidae] Immature/Adult Guild: ?/Leaf feeder

344 Dorytomus brevicollis LeConte [Coleoptera: Curculionidae]

345 Epimechus curvipes Dietz [Coleoptera: Curculionidae]

346 Epimechus spp. [Coleoptera: Curculionidae]

347 Minyomerus laticeps (Casey) [Coleoptera: Curculionidae]

348 Minyomerus spp. [Coleoptera: Curculionidae]

349 Mitostylus setosus (Sharp) [Coleoptera: Curculionidae]

350 Mitostylus tenuis Horn [Coleoptera: Curculionidae]

351 Myrmex lineata (Pascoe) [Coleoptera: Curculionidae]

352 Myrmex nr. lineata (Pascoe) [Coleoptera: Curculionidae]

353 Myrmex spp. [Coleoptera: Curculionidae]

354 Ophryastes latirostris LeConte [Coleoptera: Curculionidae]

355 Ophryastes spp. [Coleoptera: Curculionidae]

356 Pantomorus elegans (Horn) [Coleoptera: Curculionidae]

357 Pantomorus obscurus (Horn) [Coleoptera: Curculionidae]

358 Peritaxia spp. [Coleoptera: Curculionidae]

359 Sibinia spp. [Coleoptera: Curculionidae]

360 Smicronyx lutulentus Dietz [Coleoptera: Curculionidae]

361 Smicronyx sordidus LeConte [Coleoptera: Curculionidae]

362 Smicronyx spretus Dietz [Coleoptera: Curculionidae]

363 Smicronyx tesselatus Dietz [Coleoptera: Curculionidae]

364 Smicronyx nr. pleuralus Casey [Coleoptera: Curculionidae]

365 Smicronyx spp. [Coleoptera: Curculionidae] Immature/Adult Guild: ?/Flower,fruit,leaf feeder

366 Tychius spp. [Coleoptera: Curculionidae]

367 Cryptorhopalum balteatum LeConte [Coleoptera: Dermestidae]

368 Chlorochroa uhleri Stal (Green stink bug) [Hemiptera: Pentatomidae]

369 Chlorochroa persimilis Horv. [Hemiptera: Pentatomidae]

370 Thyanta custator (Fabricius) (Red-shouldered stink bug) [Hemiptera: Pentatomidae]

371 Thyanta rugulosa (Say) [Hemiptera: Pentatomidae] Immature/Adult Guild: Leaf,stem feeder/Leaf,stem feeder

372 Thyanta punctiventris Van Duzee [Hemiptera: Pentatomidae]

373 Acrosternum hilaris (Say) (Green soldier bug) [Hemiptera: Pentatomidae]

374 Banasa dimidata (Say) [Hemiptera: Pentatomidae]

375 Leptoglossus clypealis Heidemann [Hemiptera: Coreidae]

376 Harmostes reflexulus (Say) (Reflex squash bug) [Hemiptera: Coreidae] Immature/Adult Guild: Leaf,stem feeder/Leaf,stem feeder

377 Corizus hyalinus (Fabricius) (Hyaline squash bug) [Hemiptera: Coreidae]

378 Corythucha mollicula Osborn & Drake (Willow lacebug) [Hemiptera: Tingidae]

379 Anthocoris antevolens White [Hemiptera: Anthocoridae]

380 Anthocoris melanocerus Reuter [Hemiptera: Anthocoridae]

381 Lygus elisus Van Duzee [Hemiptera: Miridae]

382 Lepidopsallus rubidus (Uhler) [Hemiptera: Miridae]

383 Pilophorus clavatus (L.) [Hemiptera: Miridae]

384 Atomoscelis modestus (Van Duzee) [Hemiptera: Miridae]

385 Diphadnus appendiculatus (Hartig) (Gooseberry sawfly) [Hymenoptera: Tenthredinidae]

386 Eriocampoides limacina Retzius (Pear slug) [Hymenoptera: Tenthredinidae] Immature/Adult Guild: Skeletonizer/? Oviposition Medium: Leaf epidermis Generations Per Year: 2

387 Pteronidea ribesi (Scopoli) (Imported currant worm) [Hymenoptera: Tenthredinidae] Immature/Adult Guild: Leaf feeder/? Oviposition Medium: Leaf undersides

388 Aphaenogaster subterranea occidentalis Emery [Hymenoptera: Formicidae]

389 Formica fusca argentea Wheeler (Fuscous ant) [Hymenoptera: Formicidae]

390 Formica fusca gelida Wheeler (Fuscous ant) [Hymenoptera: Formicidae]

391 Formica fusca neorufibarbis Emery (Fuscous ant) [Hymenoptera: Formicidae]

392 Formica fusca subanescens Emery (Fuscous ant) [Hymenoptera: Formicidae]

393 Formica manni Wheeler [Hymenoptera: Formicidae]

394 Formica neogagates Emery [Hymenoptera: Formicidae]

395 Formica oreas Wheeler [Hymenoptera: Formicidae]

396 Formica oreas comptula Wheeler [Hymenoptera: Formicidae]

397 Formica rufa obscuripes Forel (Red ant) [Hymenoptera: Formicidae] Immature/Adult Guild: ?/Aphid farmer

398 Formica subpolita Emery [Hymenoptera: Formicidae] Immature/Adult Guild: ?/Aphid farmer

399 Formica truncicola intogriodos Emery [Hymenoptera: Formicidae]

400 Lasius niger sitkaensis Pergande [Hymenoptera: Formicidae]

401 Leptothorax nevadensis Wheeler [Hymenoptera: Formicidae]

402 Celerio lineata Fabricius (White-lined or striped sphinx moth) [Lepidoptera: Sphingidae] Immature/Adult Guild: Leaf feeder/? Generations Per Year: 2

403 Hippodamia apicalis Casey [Coleoptera: Coccinellidae]

404 Exema conspersa (Mann.) [Coleoptera: Chrysomelidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

405 Lina scripta (Fabricius) (Cottonwood leaf beetle) [Coleoptera: Chrysomelidae] Immature/Adult Guild: Leaf feeder/? Oviposition Medium: Leaf surfaces

406 Apion sordidum Smith [Coleoptera: Curculionidae] Immature/Adult Guild: Gall exploiter/?

407 Cercopeus artemisiae Pierce (Artemisia weevil) [Coleoptera: Curculionidae]

408 Dicerca prolongata LeConte [Coleoptera: Buprestidae] Immature/Adult Guild: Wood borer/? Oviposition Medium: Bark surfaces

409 Oxoplus corallinus LeConte [Coleoptera: Cerambycidae]

410 Saperda horni Joutel [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer: live wood/?

411 Renocis heterodoxus Casey [Coleoptera: Scolytidae] Immature/Adult Guild: Bark beetle/Bark beetle

412 Pityophthorus virilis Blkm. [Coleoptera: Scolytidae]

413 Feltia ducens Walker [Lepidoptera: Noctuidae]

414 Euxoa citricolor (Grote) [Lepidoptera: Noctuidae]

415 Trichoplusia ni (Hubner) [Lepidoptera: Noctuidae]

416 Saperda concolor LeConte [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer: live wood/?

417 Aphis sensoriata [Homoptera: Aphididae]

418 Aphalara spp. [Homoptera: Psyllidae]

419 Coccinella transversoguttata Fald. (Common red ladybird beetle) [Coleoptera: Coccinellidae]

420 Coccinella difficilis Crotch [Coleoptera: Coccinellidae]

421 Crossidius spp. (Desert shrub longhorned rootborers) [Coleoptera: Cerambycidae] Immature/Adult Guild: Root borer/Pollen feeder

422 Mordella spp. [Coleoptera: Mordellidae]

423 Olebrus spp. [Coleoptera: Phalacridae]

424 Dasytellus spp. [Coleoptera: Dasytidae]

425 Listus interruptus LeConte [Coleoptera: Dasytidae]

426 Psylliodes spp. [Coleoptera: Chrysomelidae]

427 Nysius spp. [Hemiptera: Lygaeidae]

428 Phytocoris spp. [Hemiptera: Miridae]

429 Orthotylus spp. [Hemiptera: Miridae]

430 Anaphothrips tricolor Moulton (Three-colored thrips) [Thysanoptera: Thripidae]

431 Xerophlaea peltata (Uhler) [Homoptera: Cicadellidae]

432 Aceratagallia cinerea (O. & B.) [Homoptera: Cicadellidae]

433 Empoasca spp. [Homoptera: Cicadellidae]

434 Formica rufa Linnaeus (Red ant) [Hymenoptera: Formicidae]

435 Formica canadensis [Hymenoptera: Formicidae]

436 Habrocytus spp. [Hymenoptera: Pteromalidae]

437 Gastancistrus spp. [Hymenoptera: Pteromalidae]

438 Necremnus spp. [Hymenoptera: Eulophidae]

439 Tetrastichus spp. [Hymenoptera: Eulophidae]

440 Zagrammosoma spp. [Hymenoptera: Eulophidae]

441 Eurytoma spp. [Hymenoptera: Eurytomidae]

442 Bruchophagus spp. [Hymenoptera: Eurytomidae]

443 Haltichella spp. [Hymenoptera: Chalcididae]

444 Telenomus spp. [Hymenoptera: Scelionidae]

445 Trissolcus utahensis Ashmead [Hymenoptera: Scelionidae]

446 Platygaster utahensis [Hymenoptera: Platygasteridae]

447 Isostasius spp. [Hymenoptera: Platygasteridae]

448 Microplitis croceipes (Cresson) [Hymenoptera: Braconidae]

449 Bracon spp. [Hymenoptera: Braconidae]

450 Chelonus spp. [Hymenoptera: Braconidae]

451 Agathis atripes Cresson [Hymenoptera: Braconidae]

452 Agathis spp. [Hymenoptera: Braconidae]

453 Apanteles spp. (Common braconids) [Hymenoptera: Braconidae] Immature/Adult Guild: Endoparasite/?

454 Chrysis spp. [Hymenoptera: Chrysididae]

455 Hedychridium spp. [Hymenoptera: Chrysididae]

456 Spilomena spp. [Hymenoptera: Sphecidae]

457 Diodontus spp. [Hymenoptera: Sphecidae]

458 Colletes lutzi [Hymenoptera: Colletidae]

459 Hyalomyia aldrichii Townsend [Diptera: Tachinidae]

460 Dinera grisescens (Fallen) [Diptera: Tachinidae]

461 Paragus bicolor (Fabricius) [Diptera: Syrphidae]

462 Schoenomyza dorsalis Loew [Diptera: Muscidae]

463 Mesoneura spp. [Diptera: Milichiidae]

464 Meromyza communis [Diptera: Chloropidae]

465 Olcella spp. [Diptera: Chloropidae]

466 Aciurina ferruginea (Doane) (Gall forming fruit flies) [Diptera: Chloropidae] Immature/Adult Guild: Gall former/Gall former Overwintering Stage: Eggs Oviposition Medium: Buds

467 Trupanea jonesi Curran [Diptera: Tephritidae]

468 Tephritis spp. [Diptera: Tephritidae]

469 Hylemya platura (=cilicrura Rondani) (Meigen) (Seedcorn maggot) [Diptera: Anthomyiidae] Immature/Adult Guild: Seed,seedling feeder/?

470 Scolothrips spp. [Thysanoptera: Thripidae]

471 Agapostemon spp. [Hymenoptera: Halictidae]

472 Polymerus difficilus [Hemiptera: Miridae]

473 Geocoris bullatus (Say) (Big-eyed bug) [Hemiptera: Lygaeidae] Immature/Adult Guild: Predator/Predator

474 Lygaeus pyrrhopterus Stal [Hemiptera: Lygaeidae]

475 Aphalara artemisiae Forster (Artemisia psyllid) [Homoptera: Psyllidae]

476 Empoasca aspersa [Homoptera: Cicadellidae]

477 Empoasca typhlocyboides [Homoptera: Cicadellidae]

478 Hebecephalus spp. [Homoptera: Cicadellidae]

479 Koebelia spp. [Homoptera: Cicadellidae]

480 Horogenes plutellae [Hymenoptera: Ichneumonidae]

481 Campoletis argentifrons [Hymenoptera: Ichneumonidae]

482 Torymus aeneoscapus (Huber) [Hymenoptera: Torymidae]

483 Formica spp. [Hymenoptera: Formicidae]

484 Neotephritis finalis (Loew) [Diptera: Tephritidae]

485 Stylia clathrata [Diptera: Tephritidae]

486 Tipula spp. [Diptera: Tipulidae]

487 Thaumatomyia appropinqua (Adams) [Diptera: Chloropidae]

488 Phytagromyza spp. [Diptera: Agromyzidae]

489 Neocnemedon spp. [Diptera: Syrphidae]

490 Spathidexia reinhardii [Diptera: Tachinidae]

491 Oxynops anthracinus [Diptera: Tachinidae]

492 Pholeomyia indecora [Diptera: Milichiidae]

493 Psila spp. [Diptera: Psilidae]

494 Hydnocera scabra [Coleoptera: Cleridae]

495 Eudastes spp. [Coleoptera: Dasytidae]

496 Vectura spp. [Coleoptera: Dasytidae]

497 Aphalara minutissima Crawford [Homoptera: Psyllidae]

498 Bracon erucorum (Cushman) [Hymenoptera: Braconidae]

499 Tetrasphaerops spp. [Hymenoptera: Braconidae]

500 Gonatocerus spp. [Hymenoptera: Mymaridae]

501 Platygaster spp. [Hymenoptera: Platygasteridae] Oviposition Medium: Host eggs

502 Asilus mesae (Tucker) [Diptera: Asilidae]

503 Conophorus spp. [Diptera: Bombyliidae]

504 Trupanea nigricollis [Diptera: Tephritidae]

505 Procecidochares spp. (Gall forming fruit flies) [Diptera: Tephritidae] Immature/Adult Guild: Gall former/Gall former

506 Stylia spp. [Diptera: Tephritidae]

507 Gymnosoma spp. [Diptera: Tachinidae]

508 Phytomyza spp. [Diptera: Agromyzidae]

509 Phytobia spp. [Diptera: Agromyzidae]

510 Trixoscelis spp. [Diptera: Trixoscelididae]

511 Oelolothrips spp. [Thysanoptera: Oelolothripidae]

512 Phyllopidea picta (Uhler) [Hemiptera: Miridae]

513 Psilocerus spp. [Hymenoptera: Pteromalidae]

514 Chlorocytus spp. [Hymenoptera: Pteromalidae]

515 Euderus albitarsis Zett. [Hymenoptera: Eulophidae]

516 Leioscyta ferruginipennis Goding [Homoptera: Membracidae]

517 Euderus spp. [Hymenoptera: Eulophidae]

518 Cerasia spp. [Diptera: Tachinidae]

519 Simulium spp. (Black flies) [Diptera: Simuliidae]

520 Bradysia spp. [Diptera: Sciaridae]

521 Chironomus spp. [Diptera: Chironomidae]

522 Celia spp. [Coleoptera: Carabidae]

523 Anthicus hastatus Casey [Coleoptera: Anthicidae]

524 Deraeocoris bakeri Knight [Hemiptera: Miridae]

525 Lepidopsallus spp. [Hemiptera: Miridae]

526 Onyxa aterrima (Doane) [Diptera: Tephritidae]

527 Corythucha immaculata Osborn & Drake [Hemiptera: Tingidae]

528 Cyrtolobus oblongatus [Homoptera: Membracidae]

529 Synopeas spp. [Hymenoptera: Platygasteridae]

530 Leptocera coproica [Diptera: Sphaeroceridae]

531 Aedes dorsalis (Meigen) (Brown salt marsh mosquito) [Diptera: Culicidae]

532 Texananus spp. [Homoptera: Cicadellidae]

533 Scolops spp. [Homoptera: Dictyopharidae]

534 Leptothorax spp. [Hymenoptera: Formicidae]

535 Torymus capillaceus [Hymenoptera: Torymidae]

536 Anagyrus spp. [Hymenoptera: Encyrtidae]

537 Alloneura spp. [Diptera: Pipunculidae]

538 Philygria debilis Loew [Diptera: Ephydridae]

539 Medetera spp. [Diptera: Dolichopodidae]

540 Crossidius ater LeConte [Coleoptera: Cerambycidae]

541 Attianus interstitialis [Homoptera: Cicadellidae]

542 Halictus rubicundus (Christ) [Hymenoptera: Halictidae]

543 Halictus ligatus Say [Hymenoptera: Halictidae]

544 Lasioglossum spp. [Hymenoptera: Halictidae]

545 Hylaeus spp. [Hymenoptera: Colletidae]

546 Apanteles bedelliae Viereck [Hymenoptera: Braconidae]

547 Adialytus spp. [Hymenoptera: Braconidae]

548 Bracon gelechiae [Hymenoptera: Braconidae]

549 Chelonus sericeus (Say) [Hymenoptera: Braconidae]

550 Hormius spp. [Hymenoptera: Braconidae]

551 Lysiphlebus utahensis [Hymenoptera: Braconidae]

552 Microplitis spp. [Hymenoptera: Braconidae]

553 Microctonus spp. [Hymenoptera: Braconidae]

554 Opius chewaucanus [Hymenoptera: Braconidae]

555 Calladonus montanus [Homoptera: Cicadellidae]

556 Pachyneuron spp. [Hymenoptera: Pteromalidae]

557 Chrysocharis ainsleyi Crawford [Hymenoptera: Eulophidae] Immature/Adult Guild: Endoparasite/?

558 Evylaeus spp. [Hymenoptera: Halictidae]

559 Lasiosina approximata [Diptera: Chloropidae]

560 Scymnus spp. [Coleoptera: Coccinellidae]

561 Hardya dentata [Homoptera: Cicadellidae]

562 Coenosia argenticeps [Diptera: Muscidae]

563 Pachybrachis signatus [Coleoptera: Chrysomelidae]

564 Anaspidina spp. [Coleoptera: Mordellidae]

565 Europiella spp. [Hemiptera: Miridae]

566 Leioscyta spp. [Homoptera: Membracidae]

567 Coquillettia spp. [Hemiptera: Miridae]

568 Deraeocoris brevis Uhler [Hemiptera: Miridae]

569 Ballana spp. [Homoptera: Cicadellidae]

570 Anagris spp. [Hymenoptera: Encyrtidae]

571 Brachyacantha spp. [Coleoptera: Coccinellidae]

572 Ballana aris [Homoptera: Cicadellidae]

573 Frigartus frigidus (Ball) [Homoptera: Cicadellidae]

574 Macrosteles fascifrons (Stal) [Homoptera: Cicadellidae]

575 Clastoptera spp. [Homoptera: Cercopidae]

576 Torymus koebelei [Hymenoptera: Torymidae]

577 Dendrocerus spp. [Hymenoptera: Ceraphronidae]

578 Coccinella novemnotata Herbst. [Coleoptera: Coccinellidae]

579 Empoasca conspersa [Homoptera: Cicadellidae]

580 Idiocerus morosus Ball [Homoptera: Cicadellidae]

581 Zyxaphis spp. Knowlton [Homoptera: Aphididae]

582 Formica planipilis [Hymenoptera: Formicidae]

583 Syntomosphyron spp. [Hymenoptera: Eulophidae]

584 Lasiops spp. [Diptera: Anthomyiidae]

585 Pseudodinia varipes Coq. [Diptera: Chamaemyiidae]

586 Melanoplus spp. [Orthoptera: Acrididae]

587 Aphis cryptus Pack & Knowlton [Homoptera: Aphididae]

588 Anuraphis gutierrezis [Homoptera: Aphididae]

589 Capitophorus utense [Homoptera: Aphididae]

590 Tritogenaphis utahensis [Homoptera: Aphididae]

591 Tritogenaphis gutierrezia [Homoptera: Aphididae]

592 Cavariella hendersoni [Homoptera: Aphididae]

593 Aspidaphis adjuvans rowei [Homoptera: Aphididae]

594 Aphis infrequens [Homoptera: Aphididae]

595 Aphis chrysothamnicola [Homoptera: Aphididae]

596 Kakimia ribe-utahensis Knowlton [Homoptera: Aphididae]

597 Capitophorus palmerae Knowlton [Homoptera: Aphididae]

598 Capitophorus elongatus Knowlton [Homoptera: Aphididae]

599 Epameibaphis thornleyi [Homoptera: Aphididae]

600 Epameibaphis atricornis Gillette & Palmer [Homoptera: Aphididae]

601 Epameibaphis frigidae (Oestlund) [Homoptera: Aphididae]

602 Aphis artemisicola Williams [Homoptera: Aphididae]

603 Aphis canae Williams [Homoptera: Aphididae]

604 Aphis oregonensis Wilson [Homoptera: Aphididae]

605 Macrosiphum artemisiphilus Knowlton & Allen [Homoptera: Aphididae]

606 Macrosiphum coweni (Hunter) [Homoptera: Aphididae]

607 Macrosiphum filifoliae Gillette & Palmer [Homoptera: Aphididae]

608 Macrosiphum frigidae (Oestlund0 [Homoptera: Aphididae]

609 Macrosiphum frigidicola (Gillette & Palmer) [Homoptera: Aphididae]

610 Macrosiphum jonesi Gillette & Palmer [Homoptera: Aphididae]

611 Macrosiphum ludovicianae (Oestlund) (Wormwood aphid) [Homoptera: Aphididae]

612 Tuberolachnus salignus (Gmelin) (Giant willow aphid) [Homoptera: Aphididae]

613 Melanoxantherium beulahensis (Ckl.) [Homoptera: Aphididae]

614 Melanoxantherium populea (Kalt.) [Homoptera: Aphididae]

615 Melanoxantherium bicolor (Oest.) [Homoptera: Aphididae]

616 Melanoxantherium salicis (L.) [Homoptera: Aphididae]

617 Melanoxantherium populifoliae (Fitch) [Homoptera: Aphididae]

618 Melanoxantherium smithiae (Monell) [Homoptera: Aphididae]

619 Chaitophorus nigrae Oestlund [Homoptera: Aphididae]

620 Amphicercidus pulverulens (Gill.) [Homoptera: Aphididae]

621 Cedoaphis symphoricarpi (Ths.) [Homoptera: Aphididae]

622 Hippodamia parenthesis (Say) (Parenthesis ladybird beetle) [Coleoptera: Coccinellidae] Immature/Adult Guild: Predator/Predator

623 Habronema spp. [Hemiptera: Miridae]

624 Chlamydatus obliquus [Hemiptera: Miridae]

625 Philaronia bilineata [Homoptera: Cercopidae]

626 Aceratagallia spp. [Homoptera: Cicadellidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

627 Mocuellus spp. [Homoptera: Cicadellidae]

628 Laccocera spp. [Homoptera: Delphacidae]

629 Bombus rufocinctus Cresson [Hymenoptera: Apidae]

630 Orgilus impiger [Hymenoptera: Braconidae]

631 Entedon spp. [Hymenoptera: Eulophidae]

632 Spilochalcis side (Walk.) [Hymenoptera: Chalcididae]

633 Rileya cecidomyiae Ashmead [Hymenoptera: Eurytomidae]

634 Hylemya concorda [Diptera: Anthomyiidae]

635 Wohlfahrtia spp. [Diptera: Sarcophagidae]

636 Sarcophaga spp. (Common flesh flies) [Diptera: Sarcophagidae]
Immature/Adult Guild: Saprophage/?

637 Peleteria spp. [Diptera: Tachinidae]

638 Cylindromyia spp. [Diptera: Tachinidae]

639 Oscinella spp. [Diptera: Chloropidae]

640 Mythicomyia spp. [Diptera: Bombyliidae]

641 Villa lateralis [Diptera: Bombyliidae]

642 Geron spp. [Diptera: Bombyliidae]

643 Heodes helloides [Lepidoptera: Lycaenidae]

644 Hesperia spp. [Lepidoptera: Hesperiidae]

645 Clavigerus beulahensis (Ckl.) [Homoptera: Aphididae]

646 Clavigerus bicolor (Oest.) [Homoptera: Aphididae]

647 Clavigerus salicis (L.) [Homoptera: Aphididae]

648 Clavigerus populifoliae (Fitch) [Homoptera: Aphididae]

649 Clavigerus smithiae (Monell) [Homoptera: Aphididae]

650 Aphis cerasifoliae Fitch (Chokecherry aphid) [Homoptera: Aphididae]

651 Aphis chrysothamni Wilson [Homoptera: Aphididae]

652 Aphis gregalis Knowlton [Homoptera: Aphididae]

653 Aphis maculatae Oestlund [Homoptera: Aphididae]

654 Aphis viburnicola Gillette (Snowball aphid) [Homoptera: Aphididae]

655 Cavariella capreae (Fab.) [Homoptera: Aphididae]

656 Aphis tetradymia [Homoptera: Aphididae]

657 Epameibaphis utahensis G. & P., K. & S. [Homoptera: Aphididae]

658 Flabellomicrosiphum knowltoni Smith [Homoptera: Aphididae]

659 Flabellomicrosiphum tridentatae (Wilson) [Homoptera: Aphididae]

660 Pseudoepameibaphis essigi Knowlton [Homoptera: Aphididae]

661 Pseudoepameibaphis glauca Gillette & Pack [Homoptera: Aphididae]

662 Pseudoepameibaphis tridentatae (Wilson) [Homoptera: Aphididae]

663 Pseudoepameibaphis xenotrichus Knowlton & Smith [Homoptera: Aphididae]

664 Rhopalosiphum grabhami Cockerell [Homoptera: Aphididae]

665 Rhopalosiphum rhois Monell [Homoptera: Aphididae]

666 Minuticornis gravidus Knlt. [Homoptera: Aphididae]

667 Capitophorus bitrichus Knowlton & Smith [Homoptera: Aphididae]

668 Capitophorus potentillae (Walk.) [Homoptera: Aphididae]

669 Capitophorus oestlundi Knowlton [Homoptera: Aphididae]

670 Capitophorus pycnorhysus Knowlton & Smith [Homoptera: Aphididae]

671 Capitophorus quadritrichus Knowlton & Smith [Homoptera: Aphididae]

672 Capitophorus zoomontanus Knowlton & Smith [Homoptera: Aphididae]

673 Hapalorhinus spp. [Coleoptera: Melyridae]

674 Auridius spp. [Homoptera: Cicadellidae]

675 Commellus spp. [Homoptera: Cicadellidae]

676 Stragania spp. [Homoptera: Cicadellidae]

677 Laccocera flava [Homoptera: Delphacidae]

678 Pleotrichophorus spp. [Homoptera: Aphididae]

679 Pediobius spp. [Hymenoptera: Eulophidae]

680 Pnigalio spp. [Hymenoptera: Eulophidae]

681 Pseudoencyrtus spp. [Hymenoptera: Encyrtidae]

682 Allotria spp. [Hymenoptera: Figitidae]

683 Aporeucoela spp. [Hymenoptera: Eucoilidae]

684 Diadegma plutellae [Hymenoptera: Ichneumonidae]

685 Leptoconops spp. [Diptera: Ceratopogonidae]

686 Leucopis ocellaris [Diptera: Chamaemyiidae]

687 Pseudodinia spp. [Diptera: Chamaemyiidae]

688 Liriomyza spp. [Diptera: Agromyzidae]

689 Meoneura spp. [Diptera: Carnidae]

690 Pholeomyia spp. [Diptera: Milichiidae]

691 Siphonella spp. [Diptera: Chloropidae]

692 Sepsis spp. [Diptera: Sepsidae]

693 Scolothrips sexmaculata [Thysanoptera: Thripidae]

694 Philaronia spp. [Homoptera: Cercopidae]

695 Orgilus spp. [Hymenoptera: Braconidae]

696 Tapinoma sessile (Say) (Odorous ant) [Hymenoptera: Formicidae]

697 Torymus thalassinus [Hymenoptera: Torymidae]

698 Leucostoma simplex (Fallen) [Diptera: Tachinidae]

699 Conioscinella spp. [Diptera: Chloropidae]

700 Lasiosina approximatinervis [Diptera: Chloropidae]

701 Diplotoxa versicolor [Diptera: Chloropidae]

702 Thaumatomyia annulata (Walker) [Diptera: Chloropidae]

703 Lispocephala spp. [Diptera: Muscidae]

704 Dasyhelea spp. [Diptera: Ceratopogonidae]

705 Monoxia elegans Blake [Coleoptera: Chrysomelidae]

706 Nemognatha spp. [Coleoptera: Meloidae]

707 Slaterocoris flavipes Kelt. [Hemiptera: Miridae]

708 Polymerus diffusus (Uhler) [Hemiptera: Miridae]

709 Coquillettia insignis Uhler [Hemiptera: Miridae]

710 Sinea diadema Fabricius (Spined or rapacious soldier bug) [Hemiptera: Reduviidae] Immature/Adult Guild: Predator/Predator

711 Idiocerus spp. [Homoptera: Cicadellidae]

712 Chorebus spp. [Hymenoptera: Braconidae]

713 Ammoplanus spp. [Hymenoptera: Sphecidae]

714 Ammophila spp. [Hymenoptera: Sphecidae]

715 Phthiria sulphurea Loew [Diptera: Bombyliidae]

716 Oligodranes spp. [Diptera: Bombyliidae]

717 Drapetis spp. [Diptera: Empididae]

718 Rhamphomyia spp. [Diptera: Empididae]

719 Psilopa compta [Diptera: Ephydridae]

720 Pemphigus balsamiferae Wms. [Homoptera: Aphididae]

721 Pemphigus populi-verae Fitch [Homoptera: Aphididae]

722 Pemphigus betae Doane (Beet root aphid) [Homoptera: Aphididae] Immature/Adult Guild: Root feeder/Root feeder

723 Pemphigus populicaulis Fitch (Poplar stem gall aphid) [Homoptera: Aphididae] Immature/Adult Guild: Gall former/Gall former

724 Mordvilkoja vagabunda (Walsh) [Homoptera: Aphididae]

725 Pemphigus populiramulorum Riley (Poplar twig gall aphid) [Homoptera: Aphididae] Immature/Adult Guild: Gall former/Gall former

726 Pemphigus populi-transversus Riley [Homoptera: Aphididae]

727 Nabis ferus (=americoferus Carayon) (Linnaeus) (Common damselbug) [Hemiptera: Nabidae] Immature/Adult Guild: Predator/Predator

728 Drepanaphis acerifoliae (Thomas) (Maple aphid) [Homoptera: Aphididae]

729 Drepanaphis granovskyi Smith & Knowlton [Homoptera: Aphididae]

730 Drepanaphis spicatum Smith [Homoptera: Aphididae]

731 Drepanaphis utahensis Knowlton & Smith [Homoptera: Aphididae]

732 Brachystomella parvula Schaeffer [Collembola: Poduridae]

733 Brachystomella stachi Folsom [Collembola: Poduridae]

734 Hypogastrura armata (Nicolet) [Collembola: Poduridae]

735 Hypogastrura macgillivrayi Folsom [Collembola: Poduridae]

736 Hypogastrura manubrialis Tullberg [Collembola: Poduridae]

737 Hypogastrura matura Folsom [Collembola: Poduridae]

738 Hypogastrura nivicola (Fitch) [Collembola: Poduridae]

739 Hypogastrura pseudarmatus Folsom [Collembola: Poduridae]

740 Micranurida pygmaea Borner [Collembola: Poduridae]

741 Neanura serrata Folsom (Serrate springtail) [Collembola: Poduridae]

742 Onychiurus armatus (Tullberg) [Collembola: Poduridae]

743 Onychiurus fimetarius (Linn.) (Dung springtail) [Collembola: Poduridae] Immature/Adult Guild: Saprophage/Saprophage

744 Onychiurus ramosus Folsom [Collembola: Poduridae]

745 Paranura caeca Folsom [Collembola: Poduridae]

746 Pseudachorutes lunatus Folsom [Collembola: Poduridae]

747 Pseudachorutes subcrassoides Mills [Collembola: Poduridae]

748 Tullbergia collis Bacon [Collembola: Poduridae]

749 Tullbergia granulata Mills [Collembola: Poduridae]

750 Willemia intermedia Mills [Collembola: Poduridae]

751 Willemia similis Mills [Collembola: Poduridae]

752 Xenylla grisea Axelson [Collembola: Poduridae]

753 Xenylla welchi Folsom [Collembola: Poduridae]

754 Entomobrya atrocincta Schott [Collembola: Entomobryidae]

755 Entomobrya atrocincta pseudopulchra Mills [Collembola: Entomobryidae]

756 Entomobrya knaba Wray [Collembola: Entomobryidae]

757 Entomobrya marginata Tullberg [Collembola: Entomobryidae]

758 Entomobrya multifasciata Tullberg (Many-spotted springtail) [Collembola: Entomobryidae]

759 Entomobrya nivalis Linnaeus [Collembola: Entomobryidae]

760 Entomobrya pseudoperpulchra Mills [Collembola: Entomobryidae]

761 Entomobrya purpurascens Packard [Collembola: Entomobryidae]

762 Folsomia diplophthalma (Axelson) [Collembola: Entomobryidae]

763 Folsomia elongata MacGillivray [Collembola: Entomobryidae]

764 Folsomia fimetaria (Linnaeus) [Collembola: Entomobryidae]

765 Folsomia quadrioculata (Tullberg) [Collembola: Entomobryidae]

766 Folsomides parvus Folsom [Collembola: Entomobryidae]

767 Folsomides stachi Folsom [Collembola: Entomobryidae]

768 Friesea claviseta Axelson [Collembola: Entomobryidae]

769 Isotoma cinerea (Nicolet) [Collembola: Entomobryidae]

770 Isotoma eunotabilis Folsom [Collembola: Entomobryidae]

771 Isotoma olivacea Tullberg [Collembola: Entomobryidae]

772 Isotoma trispinata MacGillivray [Collembola: Entomobryidae]

773 Isotoma viridis (Bourlet) (Green or varied springtail) [Collembola: Entomobryidae]

774 Isotomodes tenuis Folsom [Collembola: Entomobryidae]

775 Isotomurus palustris (Muller) [Collembola: Entomobryidae]

776 Lepidocyrtus curvicollis Bourlet [Collembola: Entomobryidae]

777 Lepidocyrtus cinereus Folsom [Collembola: Entomobryidae]

778 Proisotoma aquae Bacon [Collembola: Entomobryidae]

779 Proisotoma minuta Tullberg [Collembola: Entomobryidae]

780 Proisotoma titusi Folsom [Collembola: Entomobryidae]

781 Pseudosinella candida Folsom [Collembola: Entomobryidae]

782 Pseudosinella octopunctata Borner [Collembola: Entomobryidae]

783 Pseudosinella sexoculata Schott [Collembola: Entomobryidae]

784 Spinisotoma dispersa Wray [Collembola: Entomobryidae]

785 Tomocerus flavescens Tullberg [Collembola: Entomobryidae]

786 Megalothorax incerfoides Will [Collembola: Neelidae]

787 Arrhopalites caecus Tullberg [Collembola: Sminthuridae]

788 Bourletiella hortensis (Fitch) [Collembola: Sminthuridae]

789 Deuterosminthurus repandus Agren. [Collembola: Sminthuridae]

790 Dicyrtoma flammea Maynard [Collembola: Sminthuridae]

791 Sminthurides pumilis Krausbauer [Collembola: Sminthuridae]

792 Sminthurinus aureus Lubbock [Collembola: Sminthuridae]

793 Sminthurinus aureus albus Krausbauer [Collembola: Sminthuridae]

794 Sminthurinus elegans (Fitch) [Collembola: Sminthuridae]

795 Sminthurinus elegans atratus Borner [Collembola: Sminthuridae]

796 Sminthurinus minutus MacGillivray [Collembola: Sminthuridae]

797 Sminthurinus niger Lubbock [Collembola: Sminthuridae]

798 Sminthurinus quadrimaculatus (Ryder) [Collembola: Sminthuridae]

799 Sminthurinus quadrimaculatus bimaculatus Maynard [Collembola: Sminthuridae]

800 Sminthurus fitchi Folsom [Collembola: Sminthuridae]

801 Sminthurus medialis Mills [Collembola: Sminthuridae]

802 Aphaenogaster subterranea valida Wheeler [Hymenoptera: Formicidae]

803 Formica criniventris Wheeler [Hymenoptera: Formicidae]

804 Formica fusca Linnaeus (Fuscous ant) [Hymenoptera: Formicidae]

805 Formica fusca subsericea Say [Hymenoptera: Formicidae]

806 Formica haemorrhoidalis Emery [Hymenoptera: Formicidae]

807 Formica neoclara Emery [Hymenoptera: Formicidae]

808 Formica obscuripes Forel [Hymenoptera: Formicidae]

809 Formica obtusopilosa Emery [Hymenoptera: Formicidae]

810 Formica pallidefulva Linnaeus [Hymenoptera: Formicidae]

811 Formica querquetula Kennedy & Dennis [Hymenoptera: Formicidae]

812 Formica rasilis Wheeler [Hymenoptera: Formicidae]

813 Formica subpolita camponoticeps Wheeler [Hymenoptera: Formicidae]

814 Leptothorax ambiguus Emery [Hymenoptera: Formicidae]

815 Leptothorax furunculus Wheeler [Hymenoptera: Formicidae]

816 Leptothorax nitens Emery [Hymenoptera: Formicidae]

817 Leptothorax rugatulus Emery [Hymenoptera: Formicidae]

818 Myrmica americana Weber [Hymenoptera: Formicidae]

819 Myrmica hamulata Weber [Hymenoptera: Formicidae]

820 Myrmica monticola Wheeler [Hymenoptera: Formicidae]

821 Myrmica spatulata Smith [Hymenoptera: Formicidae]

822 Pogonomyrmex occidentalis (Cresson) (Western harvester ant) [Hymenoptera: Formicidae] Immature/Adult Guild: ?/Leaf,pollen,seed feeder

823 Pogonomyrmex salinus Olsen [Hymenoptera: Formicidae]

824 Stenamma spp. [Hymenoptera: Formicidae]

825 Stenamma brevicorne (Mayr) [Hymenoptera: Formicidae]

826 Stenamma huachucanum Smith [Hymenoptera: Formicidae]

827 Stenamma knowltoni Gregg [Hymenoptera: Formicidae]

828 Stenamma smithi Cole [Hymenoptera: Formicidae]

829 Adalia bipunctata (Linnaeus) (Two-spotted ladybird beetle) [Coleoptera: Coccinellidae]

830 Adalia frigida (Schneider) (Frigid ladybird beetle) [Coleoptera: Coccinellidae]

831 Brachyacantha uteella Casey [Coleoptera: Coccinellidae]

832 Brumoides septentrionis Weise. [Coleoptera: Coccinellidae]

833 Coccinella transversoguttata richardsoni Brown [Coleoptera: Coccinellidae]

834 Cycloneda munda (Say) (Western blood-red ladybird beetle) [Coleoptera: Coccinellidae]

835 Exochomus desertorum Casey [Coleoptera: Coccinellidae]

836 Hippodamia glacialis lecontei Mulsant [Coleoptera: Coccinellidae]

837 Hippodamia quinquesignata Kirby (Five-spotted ladybird beetle) [Coleoptera: Coccinellidae] Immature/Adult Guild: Predator/Predator

838 Hippodamia sinuata disjuncta Timberlake (Sinuate ladybird beetle) [Coleoptera: Coccinellidae] Immature/Adult Guild: Predator/Predator

839 Hippodamia tredecimpunctata tibialis Say [Coleoptera: Coccinellidae]

840 Hyperaspidius spp. [Coleoptera: Coccinellidae]

841 Hyperaspis spp. Melsh. [Coleoptera: Coccinellidae]

842 Hyperaspis nevadica Casey [Coleoptera: Coccinellidae]

843 Hyperaspis pleuralis Casey [Coleoptera: Coccinellidae]

844 Hyperaspis undulata (Say) [Coleoptera: Coccinellidae] Immature/Adult Guild: Predator/Predator

845 Paranaemia vittigera (Mann.) (Striped ladybird beetle) [Coleoptera: Coccinellidae] Immature/Adult Guild: Predator/Predator

846 Psyllobora borealis Casey [Coleoptera: Coccinellidae]

847 Psyllobora vigintimaculata (Say) (Small ash-gray ladybird beetle) [Coleoptera: Coccinellidae]

848 Scymnus fenderi Malkin [Coleoptera: Coccinellidae]

849 Scymnus impleta Gordon [Coleoptera: Coccinellidae]

850 Scymnus marginicollis Mann. [Coleoptera: Coccinellidae]

851 Scymnus opaculus Horn [Coleoptera: Coccinellidae]

852 Scymnus postpictus Casey [Coleoptera: Coccinellidae]

853 Scymnus renoicus Casey [Coleoptera: Coccinellidae]

854 Scymnus utahensis Gordon [Coleoptera: Coccinellidae]

855 Stenomorpha consobrina (Say) [Coleoptera: Tenebrionidae]

856 Crossidius hirtipes LeConte [Coleoptera: Cerambycidae]

857 Crossidius hirtipes allgewahri LeConte [Coleoptera: Cerambycidae]

858 Crossidius punctatus LeConte [Coleoptera: Cerambycidae]

859 Rhynchites bicolor (Fabricius) (Rose curculio) [Coleoptera: Curculionidae] Immature/Adult Guild: Bud,flower feeder/Bud,flower feeder

860 Pseuderimus spp. [Hymenoptera: Torymidae]

861 Torymus bedeguaris [Hymenoptera: Torymidae]

862 Torymus capillaceus albitarsis (Huber) [Hymenoptera: Torymidae]

863 Torymus citripes (Huber) [Hymenoptera: Torymidae]

864 Euchalcidia spp. [Hymenoptera: Chalcididae]

865 Spilochalcis leptis Burks [Hymenoptera: Chalcididae]

866 Eupelmus spp. [Hymenoptera: Eupelmidae]

867 Achrysocharis spp. [Hymenoptera: Eulophidae]

868 Diglyphus intermedia (Gric.) [Hymenoptera: Eulophidae]

869 Diglyphus websteri Crawford [Hymenoptera: Eulophidae]

870 Entedon bigeloviae Ashmead [Hymenoptera: Eulophidae]

871 Catolaccus spp. [Hymenoptera: Pteromalidae]

872 Cyclogastrella spp. [Hymenoptera: Pteromalidae]

873 Epicoptera spp. [Hymenoptera: Pteromalidae]

874 Eupteromalus spp. [Hymenoptera: Pteromalidae]

875 Galeopsomyia spp. [Hymenoptera: Pteromalidae]

876 Homoporus spp. [Hymenoptera: Pteromalidae]

877 Neocatolaccus spp. [Hymenoptera: Pteromalidae]

878 Pseudocatolaccus spp. [Hymenoptera: Pteromalidae]

879 Pteromalus spp. [Hymenoptera: Pteromalidae]

880 Sphegigastor spp. [Hymenoptera: Sphegigastrinae]

881 Thinodytes spp. [Hymenoptera: Pteromalidae]

882 Trichomalus spp. [Hymenoptera: Pteromalidae]

883 Elasmus nigripes Howard [Hymenoptera: Elasmidae]

884 Elasmus spp. [Hymenoptera: Elasmidae]

885 Thysanus niger (Ashmead) [Hymenoptera: Thysanidae]

886 Eutrichosomma mirabile Ashmead [Hymenoptera: Eutrichosomatidae]

887 Perilampus spp. [Hymenoptera: Perilampidae]

888 Eudecatoma spp. [Hymenoptera: Eurytomidae]

889 Scelion opacus Provancher [Hymenoptera: Scelionidae]

890 Aspicera spp. [Hymenoptera: Cynipoidea]

891 Cothonaspis spp. [Hymenoptera: Cynipoidea]

892 Episoda spp. [Hymenoptera: Cynipoidea]

893 Ceratochrysis perpulchra Cresson [Hymenoptera: Chrysididae]

894 Ceratochrysis dorsalis Aaron [Hymenoptera: Chrysididae]

895 Hedychrum cupricolle Cresson [Hymenoptera: Chrysididae]

896 Holopyga ventralis (Say) [Hymenoptera: Chrysididae]

897 Omalus variatua (Aaron) [Hymenoptera: Chrysididae]

898 Anoplius tenebrosus (Cresson) [Hymenoptera: Pompilidae]

899 Aporus luxus luxus (Banks) [Hymenoptera: Pompilidae]

900 Episyron oregon Evans [Hymenoptera: Pompilidae]

901 Paracyphononyx funerus (Lepeletier) [Hymenoptera: Pompilidae]

902 Andrena hirticincta Prov. [Hymenoptera: Andrenidae]

903 Andrena illinoiensis Robt. [Hymenoptera: Andrenidae]

904 Andrena sulcata Donovan [Hymenoptera: Andrenidae]

905 Perdita salicis imperialis Cockerell [Hymenoptera: Andrenidae]

906 Perdita munda Timberlake [Hymenoptera: Andrenidae]

907 Perdita parilis Timberlake [Hymenoptera: Andrenidae]

908 Perdita similis Timberlake [Hymenoptera: Andrenidae]

909 Perdita luteola Cockerell [Hymenoptera: Andrenidae]

910 Anthophora exigua Cresson [Hymenoptera: Anthophoridae]

911 Melissodes dagosa Cockerell [Hymenoptera: Anthophoridae]

912 Triepeolus timberlakei Cockerell [Hymenoptera: Anthophoridae]

913 Colletes simulans nevadensis Swenk. [Hymenoptera: Colletidae]

914 Dialictus hudsoniellus (Cockerell) [Hymenoptera: Halictidae]

915 Dialictus hyalinus (Crawford) [Hymenoptera: Halictidae]

916 Dialictus incompletus (Crawford) [Hymenoptera: Halictidae]

917 Evylaeus cooleyi (Crawford) [Hymenoptera: Halictidae]

918 Hedriodiscus truquii (Bellardi) [Hymenoptera: Stratiomyidae]

919 Nemotelus communis Hanson [Hymenoptera: Stratiomyidae]

920 Odontomyia inaequalis Loew. [Hymenoptera: Stratiomyidae]

921 Epicauta maculata Say (Spotted blister beetle) [Coleoptera: Meloidae]

922 Epicauta normalis Werner [Coleoptera: Meloidae]

923 Lytta vulnerata LeConte [Coleoptera: Meloidae]

924 Nemognatha lurida LeConte [Coleoptera: Meloidae]

925 Orthezia artemisiae Cockerell (Sagebrush orthezia) [Homoptera: Ortheziidae] Immature/Adult Guild: Sap feeder/Sap feeder

926 Phenacoccus defectus Ferris [Homoptera: Pseudococcidae]

927 Polygonia zephyrus (W.H. Edwards) [Lepidoptera: Nymphalidae]

928 Anthocoris musculus Say [Hemiptera: Anthocoridae]

929 Mineocapsus minimus Knight [Hemiptera: Miridae]

930 Phymata borica Evans [Hemiptera: Phymatidae]

931 Phymata pennsylvanica coloradensis Melin. [Hemiptera: Phymatidae]

932 Sinea confusa Caud. [Hemiptera: Reduviidae]

933 Corythucha arcuata Say (California Christmas-berry tingid) [Hemiptera: Tingidae] Immature/Adult Guild: Sap feeder/Sap feeder

934 Corythucha distincta Osborn & Drake (Distinct lacebug) [Hemiptera: Tingidae] Immature/Adult Guild: Sap feeder/Sap feeder

935 Peritrechus saskatchewanensis Barber [Hemiptera: Lygaeidae]

936 Hedriodiscus binotatus (Loew.) [Diptera: Stratiomyidae]

937 Chelonus cylindricus McComb. [Hymenoptera: Braconidae]

938 Odontomyia inaequalis communis James [Diptera: Stratiomyidae]

939 Odontomyia tumida Banks [Diptera: Stratiomyidae]

940 Anastoechus barbatus Osten Sacken [Diptera: Bombyliidae]

941 Anthrax albofasciatus daphne (Osten Sacken) [Diptera: Bombyliidae]

942 Exoprosopa divisa (Coq.) [Diptera: Bombyliidae]

943 Exoprosopa spp. [Diptera: Bombyliidae]

944 Lordotus gibbus Loew [Diptera: Bombyliidae]

945 Lordotus pulchrissimus Will. (Drone fly or rat-tailed maggot) [Diptera: Bombyliidae] Immature/Adult Guild: Saprophage/Nectar feeder

946 Phthiria spp. [Diptera: Bombyliidae]

947 Poecilanthrax sackenii sackenii (Coq.) [Diptera: Bombyliidae]

948 Poecilanthrax willistoni (Coq.) (Williston's bee fly) [Diptera: Bombyliidae]

949 Eristalis tenax (Linnaeus) (Drone fly) [Diptera: Syrphidae]

950 Eupeodes volucris Osten Sacken (Bird syrphid) [Diptera: Syrphidae]

951 Scaeva pyrastri (Linnaeus) [Diptera: Syrphidae] Immature/Adult Guild: Predator/Nectar feeder

952 Euxesta magdalenae Cresson [Diptera: Otitidae]

953 Eutreta diana (Osten Sacken) (Gall forming fruit flies) [Diptera: Tephritidae] Immature/Adult Guild: Gall former/Gall former

954 Oxyna utahensis Quisenberry [Diptera: Tephritidae]

955 Paroxyna occidentalis Novak [Diptera: Tephritidae]

956 Paroxyna pygmea Novak [Diptera: Tephritidae]

957 Paroxyna steyskali Novak [Diptera: Tephritidae]

958 Paroxyna spp. [Diptera: Tephritidae]

959 Leptometopa halteralis Coq. [Diptera: Milichiidae]

960 Madiza glabra Fallen [Diptera: Milichiidae]

961 Cyanus elongatus (Hough) [Diptera: Calliphoridae]

962 Cynomyopsis cadaverina (Robineau & Desvoidy) [Diptera: Calliphoridae]

963 Agathis nigripes Cresson [Hymenoptera: Braconidae]

964 Stenodynerus blandoides R. Bohart [Hymenoptera: Vespidae]

965 Stenodynerus kennicottianus (Saussure) [Hymenoptera: Vespidae]

966 Stenodynerus noticeps R. Bohart [Hymenoptera: Vespidae]

967 Stenodynerus valliceps R. Bohart [Hymenoptera: Vespidae]

968 Belomicrus cladothricis (Cockerell) [Hymenoptera: Sphecidae]

969 Cerceris acanthophila Cockerell [Hymenoptera: Sphecidae]

970 Cerceris convergens Viereck & Cockerell [Hymenoptera: Sphecidae]

971 Cerceris frontata Say [Hymenoptera: Sphecidae]

972 Cerceris nigrescens F. Smith [Hymenoptera: Sphecidae]

973 Cerceris rufinoda Cresson [Hymenoptera: Sphecidae]

974 Cerceris sextoides Banks [Hymenoptera: Sphecidae]

975 Diploplectron ferrugineum Ashmead [Hymenoptera: Sphecidae]

976 Ectemnius dilectus (Cresson) [Hymenoptera: Sphecidae]

977 Ectemnius spiniferus (W. Fox) [Hymenoptera: Sphecidae]

978 Eucerceris cressoni (Schletter) [Hymenoptera: Sphecidae]

979 Eucerceris superba Cresson [Hymenoptera: Sphecidae]

980 Larropsis tenuicornis (F. Smith) [Hymenoptera: Sphecidae]

981 Lindenius columbianus (Kohl) [Hymenoptera: Sphecidae]

982 Oxybelus emarginatus Say [Hymenoptera: Sphecidae]

983 Oxybelus uniglumis (Linnaeus) [Hymenoptera: Sphecidae]

984 Philanthus multimaculatus Cameron [Hymenoptera: Sphecidae]

985 Polalonia communis (Cresson) [Hymenoptera: Sphecidae]

986 Polalonia luctuosa (F. Smith) [Hymenoptera: Sphecidae]

987 Polalonia mexicana (Saussure) [Hymenoptera: Sphecidae]

988 Prionyx atrata (Lepeletier) [Hymenoptera: Sphecidae]

989 Prionyx canadensis (Provancher) [Hymenoptera: Sphecidae]

990 Prionyx thomae (F.) [Hymenoptera: Sphecidae]

991 Sphex ichneumoneus (Linnaeus) [Hymenoptera: Sphecidae]

992 Stizioides unicinctus (Say) [Hymenoptera: Sphecidae]

993 Tachysphex ashmeadii Fox [Hymenoptera: Sphecidae]

994 Tachysphex terminatus (Smith) [Hymenoptera: Sphecidae]

995 Tachytes sayi Banks [Hymenoptera: Sphecidae]

996 Pleotrichophorus acanthovillus Knowlton & Smith [Homoptera: Aphididae]

997 Microsiphoniella acophorum (Knowlton & Smith) [Homoptera: Aphididae]

998 Calaphis annulatus (Koch) [Homoptera: Aphididae]

999 Microsiphoniella artemisiae (Gilette) [Homoptera: Aphididae]

1000 Obtusicauda artemisicola (Williams) [Homoptera: Aphididae]

1001 Macrosiphum artemisaphis Knowlton & Allen [Homoptera: Aphididae]

1002 Obtusicauda artemisiphilum (Knowlton & Allen) [Homoptera: Aphididae]

1003 Hyalopterus arundinis (Fabricius) (Mealy plum aphid) [Homoptera: Aphididae] Immature/Adult Guild: Sap feeder/Sap feeder

1004 Brachyunguis bonnevillensis (Knowlton) [Homoptera: Aphididae]

1005 Periphyllus bruneri (Williams) [Homoptera: Aphididae]

1006 Acyrthosiphum californicum (Clarke) [Homoptera: Aphididae]

1007 Styletaphis canae (Williams) [Homoptera: Aphididae]

1008 Macrosiphum cefsmithi Knowlton & Allen [Homoptera: Aphididae]

1009 Styletaphis chrysothamni (Wilson) [Homoptera: Aphididae]

1010 Obtusicauda coweni (Hunter) [Homoptera: Aphididae]

1011 Nearctaphis crataegifoliae (Fitch) [Homoptera: Aphididae]

1012 Metopolophum dirhodum (Walker) [Homoptera: Aphididae]

1013 Pleotrichophorus elongatus (Knowlton) (Elongate rabbitbrush aphid) [Homoptera: Aphididae]

1014 Macrosiphum euphorbiae (Thomas) [Homoptera: Aphididae]

1015 Dactynotus escalantii (Knowlton) [Homoptera: Aphididae]

1016 Obtusicauda essigi Solimon [Homoptera: Aphididae]

1017 Styletaphis filifoliae (Gilletee & Palmer) [Homoptera: Aphididae]

1018 Chaetosiphon fraegefoliae (Cockerell) [Homoptera: Aphididae]

1019 Obtusicauda frigidae (Oestlund) [Homoptera: Aphididae]

1020 Pleotrichophorus gregarius (Knowlton) [Homoptera: Aphididae]

1021 Brachycaudus helichrysi (Kaltenbach) [Homoptera: Aphididae]

1022 Brachyunguis hermistonii (Wilson) [Homoptera: Aphididae]

1023 Pleotrichophorus infrequens (Knowlton & Smith) [Homoptera: Aphididae]

1024 Microsiphoniella ludovicianae (Oestlund) [Homoptera: Aphididae]

1025 Aphis lugentis Williams [Homoptera: Aphididae]

1026 Chaitophorus macrostachyae (Essig) [Homoptera: Aphididae]

1027 Styletaphis minutissima (Gillette & Palmer) [Homoptera: Aphididae]

1028 Aphis neomexicana (Cockerell) [Homoptera: Aphididae]

1029 Wahlgreniella nervata (Gillette) [Homoptera: Aphididae]

1030 Aphis nigragregalis Knowlton [Homoptera: Aphididae]

1031 Obtusicauda spp. [Homoptera: Aphididae]

1032 Pleotrichophorus oestlundii (Knowlton) [Homoptera: Aphididae]

1033 Styletaphis oregonensis (Wilson) [Homoptera: Aphididae]

1034 Microsiphoniella oregonensis (Wilson) [Homoptera: Aphididae]

1035 Pleotrichophorus packi (Knowlton) [Homoptera: Aphididae]

1036 Thomasiella populicola (Thomas) [Homoptera: Aphididae]

1037 Pleotrichophorus pseudoglandulosus (Palmer) [Homoptera: Aphididae]

1038 Rhopalosiphum prunifoliae (Fitch) (Apple-grain aphid) [Homoptera: Aphididae] Overwintering Stage: Eggs

1039 Cavariella pustula Essig [Homoptera: Aphididae]

1040 Chaitophorus pustulatus H.R. Lambers [Homoptera: Aphididae]

1041 Pleotrichophorus pycnorhysus (Knowlton & Smith) [Homoptera: Aphididae]

1042 Pleotrichophorus quadritrichus (Knowlton & Smith) [Homoptera: Aphididae]

1043 Amphorophora ribiella (Davis) [Homoptera: Aphididae]

1044 Maculolachnus rosae (Cholodkosky) [Homoptera: Aphididae]

1045 Cryptomyzus ribis (Linnaeus) [Homoptera: Aphididae]

1046 Macrosiphum rosae (Linnaeus) [Homoptera: Aphididae]

1047 Chaitophorus salicicola Essig [Homoptera: Aphididae]

1048 Pterocomma salicis (Linnaeus) [Homoptera: Aphididae]

1049 Aphis setariae Thomas [Homoptera: Aphididae]

1050 Pterocomma smithiae (Monell) [Homoptera: Aphididae]

1051 Aphis spiraecola Patch [Homoptera: Aphididae]

1052 Pleotrichophorus sporadicum (Knowlton) [Homoptera: Aphididae]

1053 Brevicoryne symphoricarpi (Thomas) [Homoptera: Aphididae]

1054 Chaitophorus utahensis (Knowlton) [Homoptera: Aphididae]

1055 Durocapillata utahensis Knowlton [Homoptera: Aphididae]

1056 Pleotrichophorus utahensis (Pack & Knowlton) [Homoptera: Aphididae]

1057 Aphis varians Patch [Homoptera: Aphididae]

1058 Chaitophorus viminalis Monell [Homoptera: Aphididae]

1059 Pleotrichophorus wasatchii (Knowlton) [Homoptera: Aphididae]

1060 Pleotrichophorus xerozoous (Knowlton & Smith) [Homoptera: Aphididae]

1061 Macrosiphum zerogutierrezis Smith & Knowlton [Homoptera: Aphididae]

1062 Macrosiphum zerotherum Knowlton & Allen [Homoptera: Aphididae]

1063 Brachycaudus cardui (Linnaeus) [Homoptera: Aphididae]

1064 Styletaphis chrysothamnicola (Gillette & Palmer) [Homoptera: Aphididae]

1065 Acanthoscelides aureolus (Horn) [Coleoptera: Bruchidae]

1066 Amara bifrons Gyllenhal [Coleoptera: Carabidae]

1067 Amara farcta LeConte [Coleoptera: Carabidae]

1068 Bembidion sejunctum Casey [Coleoptera: Carabidae]

1069 Evarthrus constrictus Say [Coleoptera: Carabidae]

1070 Harpalus desertus LeConte [Coleoptera: Carabidae]

1071 Piosoma setosa LeConte [Coleoptera: Carabidae]

1072 Selenophorus planipennis LeConte [Coleoptera: Carabidae]

1073 Stenolophus conjunctus LeConte [Coleoptera: Carabidae]

1074 Crossidius discoideus sayi (Say) [Coleoptera: Cerambycidae]
Immature/Adult Guild:
?/Nectar,petal,pollen feeder

1075 Altica aeruginosa LeConte [Coleoptera: Chrysomelidae]
Immature/Adult Guild: Skeletonizer/Leaf perforator

1076 Altica spp. (Leaf flea beetles) [Coleoptera: Chrysomelidae]
Immature/Adult Guild: Skeletonizer/Leaf perforator

1077 Chaetocnema spp. [Coleoptera: Chrysomelidae]

1078 Coscinoptera axillaris LeConte [Coleoptera: Chrysomelidae]

1079 Disonycha alternata (Illiger) [Coleoptera: Chrysomelidae]

1080 Disonycha figurata Jacoby [Coleoptera: Chrysomelidae]

1081 Disonycha pluriligata (LeConte) [Coleoptera: Chrysomelidae]

1082 Disonycha punctigera LeConte [Coleoptera: Chrysomelidae]

1083 Pachybrachis autolycus Fall [Coleoptera: Chrysomelidae]

1084 Trirhabda convergens LeConte [Coleoptera: Chrysomelidae]

1085 Phyllobaenus spp. [Coleoptera: Cleridae]

1086 Coccinella monticola Mulsant [Coleoptera: Coccinellidae]

1087 Delphestus pusillus (LeConte) [Coleoptera: Coccinellidae]

1088 Hyperaspis quadrivittata LeConte [Coleoptera: Coccinellidae]

1089 Anthonomus ochreopilosus Dietz [Coleoptera: Curculionidae]

1090 Calandrinus insignis Casey [Coleoptera: Curculionidae]

1091 Calyptillus cryptops Horn [Coleoptera: Curculionidae]

1092 Cleonus trivittatus Say [Coleoptera: Curculionidae]

1093 Dorytomus mucidus (Say) [Coleoptera: Curculionidae]

1094 Epicaerus spp. [Coleoptera: Curculionidae]

1095 Epimechus nevadicus Dietz [Coleoptera: Curculionidae]

1096 Gerstaeckeria basalis (LeConte) [Coleoptera: Curculionidae]

1097 Mesagroicus spp. [Coleoptera: Curculionidae]

1098 Ophryastes tuberosus LeConte [Coleoptera: Curculionidae]

1099 Promecotarsus fumatus Casey [Coleoptera: Curculionidae]

1100 Rhynchites eximius LeConte [Coleoptera: Curculionidae]

1101 Sitona cylindricollis Fahraeus [Coleoptera: Curculionidae]

1102 Sphenophorus compressirostris Say [Coleoptera: Curculionidae]

1103 Ctenicera spp. (Common click beetles) [Coleoptera: Elateridae]

1104 Hister abbreviatus Fabricius [Coleoptera: Histeridae]

1105 Spilodiscus ulkei Horn [Coleoptera: Histeridae]

1106 Spilodiscus spp. [Coleoptera: Histeridae]

1107 Xerosaprinus fimbriatus LeConte [Coleoptera: Histeridae]

1108 Epicauta fortis Werner [Coleoptera: Meloidae]

1109 Epicauta parva Haldeman [Coleoptera: Meloidae]

1110 Epicauta pennsylvanica DeGeer (Black blister beetle) [Coleoptera: Meloidae]

1111 Epicauta stuarti LeConte [Coleoptera: Meloidae]

1112 Lytta viridana LeConte [Coleoptera: Meloidae]

1113 Meloe niger Kirby [Coleoptera: Meloidae]

1114 Pyrota engelmanni LeConte [Coleoptera: Meloidae]

1115 Trichochrous rufipennis LeConte [Coleoptera: Melyridae]

1116 Aphodius consentaneus LeConte [Coleoptera: Scarabaeidae]

1117 Aphodius granarius (Linnaeus) [Coleoptera: Scarabaeidae]

1118 Cremastocheilus retrasctus incisus Casey [Coleoptera: Scarabaeidae]

1119 Euphoria inda (Linnaeus) (Bumble flower beetle) [Coleoptera: Scarabaeidae] Immature/Adult Guild: Saprophage/Fruit feeder

1120 Phyllophaga spp. [Coleoptera: Scarabaeidae]

1121 Trichorhyssemus riparius (Horn) [Coleoptera: Scarabaeidae]

1122 Trox tuberculatus (DeGeer) [Coleoptera: Scarabaeidae]

1123 Aleochara bipustulata Linnaeus [Coleoptera: Staphylinidae]

1124 Anotylus spp. [Coleoptera: Staphylinidae]

1125 Bledius strenuus Casey [Coleoptera: Staphylinidae]

1126 Blapstinus spp. [Coleoptera: Tenebrionidae]

1127 Eleodes obscura (Say) [Coleoptera: Tenebrionidae]

1128 Eusattus convexus LeConte [Coleoptera: Tenebrionidae]

1129 Glyptasida sordida (LeConte) [Coleoptera: Tenebrionidae]

1130 Gonasida elata (LeConte) [Coleoptera: Tenebrionidae]

1131 Trimytis pruinosa LeConte [Coleoptera: Tenebrionidae]

1132 Entomobrya spp. [Collembola: Entomobryidae]

1133 Aphoebantus spp. [Diptera: Bombyliidae]

1134 Poecilanthrax arethusa (Osten Sacken) [Diptera: Bombyliidae]

1135 Villa spp. [Diptera: Bombyliidae]

1136 Diamesa spp. [Diptera: Chironomidae]

1137 Elachiptera costata (Loew) [Diptera: Chloropidae]

1138 Hippelates pusio Loew [Diptera: Chloropidae]

1139 Ravinia spp. [Diptera: Sarcophagidae]

1140 Leptocera spp. [Diptera: Sphaeroceridae]

1141 Helophilus spp. [Diptera: Syrphidae]

1142 Leucostoma atterimum (Villers) [Diptera: Tachinidae]

1143 Periscepsia laevigata (Wulp) [Diptera: Tachinidae]

1144 Microchaetina valida (Townsend) [Diptera: Tachinidae]

1145 Pangeaus congruus (Uhler) [Hemiptera: Cydnidae]

1146 Blissus leucopterus (Say) (Chinch bug) [Hemiptera: Lygaeidae]

1147 Slaterocoris spp. [Hemiptera: Miridae]

1148 Euptychodera corrugata (Van Duzee) [Hemiptera: Scutelleridae]

1149 Corythaica acuta (Drake) [Hemiptera: Tingidae]

1150 Hesperotingis spp. [Hemiptera: Tingidae]

1151 Capitophorus spp. [Homoptera: Aphididae]

1152 Iziphya spp. [Homoptera: Aphididae]

1153 Macrosiphum spp. [Homoptera: Aphididae]

1154 Aceratagallia humulis Oman [Homoptera: Cicadellidae]

1155 Athysanella spp. [Homoptera: Cicadellidae]

1156 Cuerna spp. [Homoptera: Cicadellidae]

1157 Gillettiella atropunctata (Gillette) [Homoptera: Cicadellidae]

1158 Parabolocratus spp. [Homoptera: Cicadellidae]

1159 Scolops sulcipes (Say) [Homoptera: Dictyopharidae]

1160 Bruchomorpha suturalis Melichar [Homoptera: Issidae]

1161 Margarodes hiemalis Cockerell [Homoptera: Margarodidae]

1162 Pubilia modesta Uhler (Modest treehopper) [Homoptera: Membracidae]

1163 Stictocephala taurina (Fitch) [Homoptera: Membracidae]

1164 Anisococcus oregonensis Ferris [Homoptera: Membracidae]

1165 Cryptoripersia arizonensis (Ehrhorn) [Homoptera: Pseudococcidae]

1166 Epeolus minimus Robertson [Hymenoptera: Anthophoridae]

1167 Melecta pacifica fulvida Cresson [Hymenoptera: Anthophoridae]

1168 Tetralonia hamata Bradley [Hymenoptera: Anthophoridae]

1169 Zele spp. [Hymenoptera: Braconidae]

1170 Colletes salicicola Cockerell [Hymenoptera: Colletidae]

1171 Orasema viridis Ashmead [Hymenoptera: Eucharitidae]

1172 Stenodynerus spp. [Hymenoptera: Eumenidae]

1173 Lasius alienus americanus Emery [Hymenoptera: Formicidae]

1174 Leptothorax tricarinatus Emery [Hymenoptera: Formicidae]

1175 Myrmica sabuleti americana Weber [Hymenoptera: Formicidae]

1176 Myrmica spp. [Hymenoptera: Formicidae]

1177 Dialictus pruinosiforme (Crawford) [Hymenoptera: Halictidae]

1178 Halictus confusus Smith [Hymenoptera: Halictidae]

1179 Anomalon reticulatum (Cresson) [Hymenoptera: Ichneumonidae]

1180 Campoplex spp. [Hymenoptera: Ichneumonidae]

1181 Olesicampe spp. [Hymenoptera: Ichneumonidae]

1182 Cryptocheilus terminatum (Say) [Hymenoptera: Pompilidae]

1183 Mesopolobus spp. [Hymenoptera: Pteromalidae]

1184 Philanthus spp. [Hymenoptera: Sphecidae]

1185 Myzinum quinquecinctum (Fabricius) [Hymenoptera: Tiphiidae]

1186 Ufens spp. [Hymenoptera: Trichogrammatidae]

1187 Polistes fuscatus aurifer Saussure [Hymenoptera: Vespidae]

1188 Reticulitermes spp. [Isoptera: Rhinotermitidae] Immature/Adult Guild: Dead stem borer/Dead stem borer

1189 Apantesis blakei Grote [Lepidoptera: Arctiidae]

1190 Gnorimoschema spp. [Lepidoptera: Gelechiidae]

1191 Hesperia uncas uncas Edwards [Lepidoptera: Hesperiidae]

1192 Pyrgus communis communis (Grote) [Lepidoptera: Hesperiidae]

1193 Prodoxus quinquepunctellus (Chamberlin) [Lepidoptera: Incurvariidae]

1194 Yvretta rhesis (Edwards) [Lepidoptera: Incurvariidae]

1195 Glaucopsyche lygdamus oro Scudder [Lepidoptera: Lycaenidae] Immature/Adult Guild: Flower feeder/?

1196 Lycaeides melissa melissa (Edwards) [Lepidoptera: Lycaenidae]

1197 Plebejus acmon lutzi dos Passos [Lepidoptera: Lycaenidae]

1198 Anagrapha falcifera (Kirby) [Lepidoptera: Noctuidae]

1199 Euxoa spp. (Grote) [Lepidoptera: Noctuidae]

1200 Schinia cumatilis Grote [Lepidoptera: Noctuidae]

1201 Phyciodes campestris camillus Edwards [Lepidoptera: Nymphalidae]

1202 Epiblema spp. [Lepidoptera: Olethreutidae] Immature/Adult Guild: Stem feeder/?

1203 Eucosma spp. [Lepidoptera: Olethreutidae]

1204 Pieris protodice protodice Boisduvall & LeConte (Southern cabbage butterfly) [Lepidoptera: Pieridae]

1205 Aeropedellus clavatus (Thomas) [Orthoptera: Acrididae]

1206 Arphia conspersa (Scudder) [Orthoptera: Acrididae]

1207 Derotmema haydenii (Thomas) [Orthoptera: Acrididae]

1208 Dissosteira carolina (Linnaeus) (Carolina or black-winged locust) [Orthoptera: Acrididae] Immature/Adult Guild: Leaf feeder/Leaf feeder

1209 Hesperotettix viridis (Thomas) [Orthoptera: Acrididae]

1210 Melanoplus foedus Scudder (Detestable grasshopper) [Orthoptera: Acrididae]

1211 Melanoplus gladstoni Scudder [Orthoptera: Acrididae] Immature/Adult Guild: Leaf feeder/Leaf feeder

1212 Melanoplus sanguinipes (Fabricius) (Migratory grasshopper) [Orthoptera: Acrididae] Immature/Adult Guild: Leaf feeder/Leaf feeder Oviposition Medium: Soil,plant crowns Generations Per Year: 1-2

1213 Mestobregma plattei (Thomas) [Orthoptera: Acrididae]

1214 Opeia obscura (Thomas) [Orthoptera: Acrididae]

1215 Philibostroma quadrimaculatum (Thomas) [Orthoptera: Acrididae]

1216 Psoloessa delicatula Scudder [Orthoptera: Acrididae]

1217 Spharagemon equale (Say) [Orthoptera: Acrididae]

1218 Xanthippus corallipes (Haldeman) [Orthoptera: Acrididae]

1219 Litaneutria minor (Scudder) (Minor mantid) [Orthoptera: Acrididae] Immature/Adult Guild: Predator/Predator

1220 Oecanthus quadripunctatus Beutenmuller (Four-spotted tree cricket) [Orthoptera: Gryllidae]

1221 Kurtomathrips unicolor Bailey [Orthoptera: Gryllidae]

1222 Microcephalothrips abdominalis (Crawford) [Orthoptera: Gryllidae]

1223 Periphyllus utahensis (Knowlton) [Homoptera: Aphididae]

1224 Periphyllus macrostachyae (Essig) [Homoptera: Aphididae]

1225 Pterocomma populea Kalt. [Homoptera: Aphididae]

1226 Bipersona hottesi Knowlton & Smith [Homoptera: Aphididae]

1227 Macrosiphum dirhodum (Walker) (Grass aphid) [Homoptera: Aphididae]

1228 Macrosiphum packi Knowlton [Homoptera: Aphididae]

1229 Macrosiphum pseudorosae Patch [Homoptera: Aphididae]

1230 Macrosiphum sporadicum Knowlton [Homoptera: Aphididae]

1231 Sternochetus lapathi (Linnaeus) [Coleoptera: Curculionidae] Immature/Adult Guild: Stem borer/Oviposition damage

1232 Chrysobothris mali Horn (Western flat-headed apple tree borer) [Coleoptera: Buprestidae] Immature/Adult Guild: Wood borer/? Oviposition Medium: Bark surfaces

1233 Nabidae spp. (Damsel bugs) [Hemiptera: Nabidae] Immature/Adult Guild: Predator/Predator

1234 Anthocoridae spp. (Minute pirate bugs) [Hemiptera: Anthocoridae] Immature/Adult Guild: Predator/Predator

1235 Miridae spp. (Plant or leaf bugs) [Hemiptera: Miridae] Immature/Adult Guild: Bud,leaf,seed feeder/Bud,leaf,seed feeder

1236 Lygaeidae spp. (Seed bugs) [Hemiptera: Lygaeidae] Immature/Adult Guild: Seed feeder/Seed feeder

1237 Chrysopidae spp. (Common lacewings) [Neuroptera: Chrysopidae] Immature/Adult Guild: Predator/?

1238 Chrysomelidae spp. (Leaf beetles) [Coleoptera: Chrysomelidae] Immature/Adult Guild: ?/Flower,leaf feeder

1239 Thripidae spp. [Thysanoptera: Thripidae]

1240 Phlaeothripidae spp. (Thrips) [Thysanoptera: Phlaeothripidae]

1241 Aeolothripidae spp. (Broad-winged or banded thrips) [Thysanoptera: Aeolothripidae]

1242 Sminthuridae spp. (Collembola or springtails) [Collembola: Sminthuridae]

1243 Poduridae spp. (Collembola or springtails) [Collembola: Poduridae] Immature/Adult Guild: Saprophage/Saprophage

1244 Onychiuridae spp. (Collembola or springtails) [Collembola: Onychiuridae] Immature/Adult Guild: Saprophage/Saprophage

1245 Entomobryidae spp. (Collembola or springtails) [Collembola: Entomobryidae] Immature/Adult Guild: Saprophage/Saprophage

1246 Isotomidae spp. (Collembola or springtails) [Collembola: Isotomidae] Immature/Adult Guild: Saprophage/Saprophage

1247 Tetrigidae spp. (Pygmy grasshoppers or grouse locusts) [Orthoptera: Tetrigidae]

1248 Acrididae spp. (Short-horned grasshoppers) [Orthoptera: Acrididae] Immature/Adult Guild: Leaf feeder/Leaf feeder

1249 Tridactylidae spp. (Pygmy mole crickets) [Orthoptera: Tridactylidae]

1250 Tettigoniidae spp. (Long-horned grasshoppers) [Orthoptera: Tettigoniidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

1251 Gryllacrididae spp. (Wingless long-horned grasshoppers) [Orthoptera: Gryllacrididae]

1252 Gryllidae spp. (Crickets) [Orthoptera: Gryllidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

1253 Gryllotalpidae spp. (Mole crickets) [Orthoptera: Gryllotalpidae]

1254 Phasmatidae spp. (Walkingsticks) [Orthoptera: Phasmatidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

1255 Mantidae spp. (Mantids or mantises) [Orthoptera: Mantidae] Immature/Adult Guild: Predator/Predator

1256 Blattidae spp. (Cockroaches) [Orthoptera: Blattidae]

1257 Blattellidae spp. (Cockroaches) [Orthoptera: Blattellidae]

1258 Forficulidae spp. (Earwigs) [Dermaptera: Forficulidae]

1259 Labiduridae spp. (Earwigs) [Dermaptera: Labiduridae]

1260 Labiidae spp. (Earwigs) [Dermaptera: Labiidae]

1261 Chelisochidae spp. (Earwigs) [Dermaptera: Chelisochidae]

1262 Termitidae spp. (Termites) [Isoptera: Termitidae]

1263 Kalotermitidae spp. (Termites) [Isoptera: Kalotermitidae]

1264 Rhinotermitidae spp. (Termites) [Isoptera: Rhinotermitidae]

1265 Hodotermitidae spp. (Dampwood termites) [Isoptera: Hodotermitidae]

1266 Merothripidae spp. (Thrips) [Thysanoptera: Merothripidae]

1267 Heterothripidae spp. (Thrips) [Thysanoptera: Heterothripidae]

1268 Corixidae spp. (Water boatmen) [Hemiptera: Corixidae]

1269 Notonectidae spp. (Backswimmers) [Hemiptera: Notonectidae]

1270 Reduviidae spp. (Assassin bugs) [Hemiptera: Reduviidae] Immature/Adult Guild: Predator/Predator

1271 Phymatidae spp. (Ambush bugs) [Hemiptera: Phymatidae]

1272 Tingidae spp. (Lace bugs) [Hemiptera: Tingidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

1273 Aradidae spp. (Flat bugs or fungus bugs) [Hemiptera: Aradidae] Immature/Adult Guild: Fungus feeder,saprophage/Fungus feeder,saprophage

1274 Piesmatidae spp. (Ash-gray leaf bugs) [Hemiptera: Piesmatidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

1275 Berytidae spp. (Stilt bugs) [Hemiptera: Berytidae]

1276 Largidae spp. [Hemiptera: Largidae]

1277 Pyrrhocoridae spp. (Red bugs and stainers) [Hemiptera: Pyrrhocoridae] Immature/Adult Guild: Seed feeder/Seed feeder

1278 Coreidae spp. (Leaf-footed bugs) [Hemiptera: Coreidae]

1279 Rhopalidae spp. (Scentless plant bugs) [Hemiptera: Rhopalidae]

1280 Alydidae spp. (Broad-headed bugs) [Hemiptera: Alydidae]

1281 Scutelleridae spp. [Hemiptera: Scutelleridae]

1282 Pentatomidae spp. (Stink bugs) [Hemiptera: Pentatomidae]

1283 Cydnidae spp. (Burrower bugs) [Hemiptera: Cydnidae]

1284 Corimelaenidae spp. (Negro bugs) [Hemiptera: Corimelaenidae]

1285 Cicadidae spp. (Cicadas) [Homoptera: Cicadidae]

1286 Membracidae spp. (Treehoppers) [Homoptera: Membracidae]

1287 Cercopidae spp. (Froghoppers or spittlebugs) [Homoptera: Cercopidae]

1288 Cicadellidae spp. [Homoptera: Cicadellidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

1289 Delphacidae spp. (Planthoppers) [Homoptera: Delphacidae]

1290 Fulgoridae spp. (Planthoppers) [Homoptera: Fulgoridae]

1291 Flatidae spp. (Planthoppers) [Homoptera: Flatidae]

1292 Acanaloniidae spp. (Planthoppers) [Homoptera: Acanaloniidae]

1293 Issidae spp. (Planthoppers) [Homoptera: Issidae]

1294 Derbidae spp. (Planthoppers) [Homoptera: Derbidae]

1295 Cixiidae spp. (Planthoppers) [Homoptera: Cixiidae]

1296 Kinnaridae spp. (Planthoppers) [Homoptera: Kinnaridae]

1297 Dictyopharidae spp. (Planthoppers) [Homoptera: Dictyopharidae]

1298 Achilidae spp. (Planthoppers) [Homoptera: Achilidae]

1299 Tropiduchidae spp. (Planthoppers) [Homoptera: Tropiduchidae]

1300 Psyllidae spp. (Jumping plantlice or psyllids) [Homoptera: Psyllidae] Immature/Adult Guild: Sap feeder/Sap feeder

1301 Aleyrodidae spp. (Whiteflies) [Homoptera: Aleyrodidae]

1302 Aphididae spp. (Aphids or plantlice) [Homoptera: Aphididae] Immature/Adult Guild: Sap feeder/Sap feeder

1303 Eriosomatidae spp. (Woolly and gall-making aphids) [Homoptera: Eriosomatidae]

1304 Chermidae spp. [Homoptera: Chermidae]

1305 Phylloxeridae spp. (Phylloxerans) [Homoptera: Phylloxeridae]

1306 Margarodidae spp. (Giant coccids or ground pearls) [Homoptera: Margarodidae]

1307 Ortheziidae spp. (Ensign coccids) [Homoptera: Ortheziidae]

1308 Diaspididae spp. (Armored scales) [Homoptera: Diaspididae]

1309 Coccidae spp. (Soft,wax,and tortoise scales) [Homoptera: Coccidae]

1310 Aclerdidae spp. (Scale) [Homoptera: Aclerdidae]

1311 Lacciferidae spp. (Lac scales) [Homoptera: Lacciferidae]

1312 Asterolecaniidae spp. (Pit scales) [Homoptera: Asterolecaniidae]

1313 Pseudococcidae spp. (Mealybugs) [Homoptera: Pseudococcidae]

1314 Eriococcidae spp. (Mealybugs) [Homoptera: Eriococcidae]

1315 Dactylopiidae spp. (Cochineal coccids) [Homoptera: Dactylopiidae]

1316 Kermidae spp. (Gall-like coccids) [Homoptera: Kermidae]

1317 Raphidiidae spp. [Neuroptera: Raphidiidae]

1318 Mantispidae spp. (Mantidflies) [Neuroptera: Mantispidae] Immature/Adult Guild: Parasite/Predator

1319 Hemerobiidae spp. (Brown lacewings) [Neuroptera: Hemerobiidae] Immature/Adult Guild: Predator/?

1320 Myrmeleontidae spp. (Ant lions) [Neuroptera: Myrmeleontidae] Immature/Adult Guild: Predator/?

1321 Ascalaphidae spp. (Owlflies) [Neuroptera: Ascalaphidae] Immature/Adult Guild: Predator/?

1322 Rhysodidae spp. (Wrinkled bark beetles) [Coleoptera: Rhysodidae]

1323 Cicindelidae spp. (Tiger beetles) [Coleoptera: Cicindelidae] Immature/Adult Guild: Predator/Predator

1324 Carabidae spp. (Ground beetles) [Coleoptera: Carabidae] Immature/Adult Guild: Predator/Predator

1325 Histeridae spp. (Hister beetles) [Coleoptera: Histeridae]

1326 Staphylinidae spp. (Rove beetles) [Coleoptera: Staphylinidae]

1327 Pselaphidae spp. (Short-winged mold beetles) [Coleoptera: Pselaphidae]

1328 Ptiliidae spp. (Feather-winged beetles) [Coleoptera: Ptiliidae]

1329 Leiodidae spp. (Round fungus beetles) [Coleoptera: Leiodidae]

1330 Silphidae spp. (Carrion beetles) [Coleoptera: Silphidae] Immature/Adult Guild: Carrion feeder/Carrion feeder

1331 Scaphidiidae spp. (Shining fungus beetles) [Coleoptera: Scaphidiidae] Immature/Adult Guild: Saprophage/Saprophage

1332 Helodidae spp. (Marsh beetles) [Coleoptera: Helodidae]

1333 Dascillidae spp. (Soft-bodied plant beetles) [Coleoptera: Dascillidae]

1334 Rhipiceridae spp. (Cedar beetles) [Coleoptera: Rhipiceridae] Immature/Adult Guild: Parasite/?

1335 Lucanidae spp. (Stag beetles) [Coleoptera: Lucanidae] Immature/Adult Guild: Saprophage/?

1336 Passalidae spp. (Bess beetles) [Coleoptera: Passalidae] Immature/Adult Guild: Wood borer/Wood borer

1337 Scarabaeidae spp. (Scarab beetles) [Coleoptera: Scarabaeidae]

1338 Byrrhidae spp. (Pill beetles) [Coleoptera: Byrrhidae]

1339 Buprestidae spp. (Metallic wood boring beetles) [Coleoptera: Buprestidae] Immature/Adult Guild: Wood borer/? Oviposition Medium: Bark surfaces

1340 Elateridae spp. (Click beetles) [Coleoptera: Elateridae]

1341 Throscidae spp. [Coleoptera: Throscidae]

1342 Lampyridae spp. (Lightning bugs or fireflies) [Coleoptera: Lampyridae] Immature/Adult Guild: Predator/?

1343 Cantharidae spp. (Soldier beetles) [Coleoptera: Cantharidae]

1344 Lycidae spp. (Net-winged beetles) [Coleoptera: Lycidae]

1345 Dermestidae spp. (Dermestid or skin beetles) [Coleoptera: Dermestidae]

1346 Anobiidae spp. [Coleoptera: Anobiidae]

1347 Ptinidae spp. (Spider beetles) [Coleoptera: Ptinidae]

1348 Bostrichidae spp. (Twig and branch borers) [Coleoptera: Bostrichidae] Immature/Adult Guild: Wood borer/?

1349 Lyctidae spp. (Powder-post beetles) [Coleoptera: Lyctidae] Immature/Adult Guild: Wood borer/?

1350 Trogositidae spp. (Bark-gnawing beetles) [Coleoptera: Trogositidae] Immature/Adult Guild: Predator/Predator

1351 Cleridae spp. (Checkered beetles) [Coleoptera: Cleridae] Immature/Adult Guild: Predator/Predator

1352 Melyridae spp. (Soft-winged flower beetles) [Coleoptera: Melyridae] Immature/Adult Guild: Predator/Predator

1353 Nitidulidae spp. (Sap beetles) [Coleoptera: Nitidulidae]

1354 Rhizophagidae spp. [Coleoptera: Rhizophagidae]

1355 Cucujidae spp. (Flat bark beetles) [Coleoptera: Cucujidae] Immature/Adult Guild: Predator/Predator

1356 Cryptophagidae spp. (Silken fungus beetles) [Coleoptera: Cryptophagidae] Immature/Adult Guild: Saprophage/Saprophage

1357 Languriidae spp. (Lizard beetles) [Coleoptera: Languriidae] Immature/Adult Guild: Stem borer/?

1358 Erotylidae spp. (Pleasing fungus beetles) [Coleoptera: Erotylidae] Immature/Adult Guild: Saprophage/Saprophage

1359 Phalacridae spp. (Shining flower beetles) [Coleoptera: Phalacridae] Immature/Adult Guild: Flower feeder/?

1360 Cerylonidae spp. [Coleoptera: Cerylonidae]

1361 Corylophidae spp. (Minute fungus beetles) [Coleoptera: Corylophidae] Immature/Adult Guild: Saprophage/Saprophage

1362 Coccinellidae spp. (Ladybird beetles) [Coleoptera: Coccinellidae] Immature/Adult Guild: Predator/Predator

1363 Endomychidae spp. (Handsome fungus beetles) [Coleoptera: Endomychidae] Immature/Adult Guild: Fungus feeder/Fungus feeder

1364 Lathridiidae spp. (Minute brown scavenger beetles) [Coleoptera: Lathridiidae]

1365 Byturidae spp. (Fruitworm beetles) [Coleoptera: Byturidae]

1366 Mycetophagidae spp. (Hairy fungus beetle) [Coleoptera: Mycetophagidae] Immature/Adult Guild: Fungus feeder/Fungus feeder

1367 Ciidae spp. (Minute tree fungus beetle) [Coleoptera: Ciidae] Immature/Adult Guild: Fungus feeder/Fungus feeder

1368 Monommidae spp. [Coleoptera: Monommidae]

1369 Colydiidae spp. (Cylindrical bark beetles) [Coleoptera: Colydiidae]

1370 Tenebrionidae spp. (Darkling beetles) [Coleoptera: Tenebrionidae]

1371 Lagriidae spp. (Long-jointed beetles) [Coleoptera: Lagriidae]

1372 Alleculidae spp. (Comb-clawed beetles) [Coleoptera: Alleculidae]

1373 Salpingidae spp. (Narrow-waisted bark beetles) [Coleoptera: Salpingidae] Immature/Adult Guild: Predator/Predator

1374 Pyrochroidae spp. (Fire-colored beetles) [Coleoptera: Pyrochroidae]

1375 Othniidae spp. (False tiger beetles) [Coleoptera: Othniidae]

1376 Mycteridae spp. [Coleoptera: Mycteridae]

1377 Oedemeridae spp. [Coleoptera: Oedemeridae]

1378 Melandryidae spp. (False darkling beetles) [Coleoptera: Melandryidae]

1379 Mordellidae spp. (Tumbling flower beetles) [Coleoptera: Mordellidae]

1380 Rhipiphoridae spp. (Wedge-shaped beetles) [Coleoptera: Rhipiphoridae]

1381 Meloidae spp. (Blister beetles) [Coleoptera: Meloidae]

1382 Anthicidae spp. (Ant-like flower beetles) [Coleoptera: Anthicidae]

1383 Pedilidae spp. [Coleoptera: Pedilidae]

1384 Cerambycidae spp. (Long-horned beetles) [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/Flower feeder

1385 Bruchidae spp. (Seed beetles) [Coleoptera: Bruchidae] Immature/Adult Guild: Internal seed feeder/?

1386 Anthribidae spp. (Fungus weevils) [Coleoptera: Anthribidae]

1387 Brentidae spp. (Straight-snouted weevils) [Coleoptera: Brentidae]

1388 Curculionidae spp. (Snout beetles or weevils) [Coleoptera: Curculionidae]

1389 Platypodidae spp. (Pin-hole borers) [Coleoptera: Platypodidae] Immature/Adult Guild: Fungus feeder/Wood borer

1390 Scolytidae spp. (Bark or engraver beetles) [Coleoptera: Scolytidae] Immature/Adult Guild: ?/Wood borer

1391 Pyralidae spp. (Snout and grass moths) [Lepidoptera: Pyralidae]

1392 Pterophoridae spp. (Plume moths) [Lepidoptera: Pterophoridae]

1393 Olethreutidae spp. [Lepidoptera: Olethreutidae]

1394 Tortricidae spp. [Lepidoptera: Tortricidae] Immature/Adult Guild: Leaf rollers,tiers/?

1395 Cossidae spp. (Carpenter or leopard moths) [Lepidoptera: Cossidae]

1396 Gelechiidae spp. [Lepidoptera: Gelechiidae]

1397 Oecophoridae spp. [Lepidoptera: Oecophoridae]

1398 Sesiidae spp. (Clear-winged moths) [Lepidoptera: Sesiidae] Immature/Adult Guild: Root,stem,wood borer/?

1399 Coleophoridae spp. (Casebearers) [Lepidoptera: Coleophoridae] Immature/Adult Guild: Leaf feeder/?

1400 Gracilariidae spp. (Leaf blotch miners) [Lepidoptera: Gracilariidae] Immature/Adult Guild: Leaf miner/?

1401 Psychidae spp. (Bagworm moths) [Lepidoptera: Psychidae] Immature/Adult Guild: Leaf feeder/?

1402 Incurvariidae spp. [Lepidoptera: Incurvariidae]

1403 Geometridae spp. (Mewasuring worms or geometers) [Lepidoptera: Geometridae]

1404 Drepanidae spp. (Hook-tip moths) [Lepidoptera: Drepanidae] Immature/Adult Guild: Leaf feeder/?

1405 Arctiidae spp. (Tiger and footman moths) [Lepidoptera: Arctiidae] Immature/Adult Guild: ?/Leaf feeder

1406 Agaristidae spp. (Forester moths) [Lepidoptera: Agaristidae] Immature/Adult Guild: Leaf feeder/?

1407 Noctuidae spp. [Lepidoptera: Noctuidae]

1408 Notodontidae spp. (Prominents) [Lepidoptera: Notodontidae] Immature/Adult Guild: Leaf feeder/?

1409 Liparidae spp. (Tussock mtohs) [Lepidoptera: Liparidae] Immature/Adult Guild: Leaf feeder/?

1410 Lasiocampidae spp. (Tent caterpillars or lappet moths) [Lepidoptera: Lasiocampidae] Immature/Adult Guild: Leaf feeder/?

1411 Saturniidae spp. (Giant silkworm or royal moths) [Lepidoptera: Saturniidae]

1412 Sphingidae spp. (Sphinx or hawk moths) [Lepidoptera: Sphingidae]

1413 Hesperiidae spp. (Skipper) [Lepidoptera: Hesperiidae] Immature/Adult Guild: Leaf feeder/?

1414 Lycaenidae spp. (Gossamer-winged butterflies) [Lepidoptera: Lycaenidae]

1415 Pieridae spp. (Whites,sulfurs,and orange-tips) [Lepidoptera: Pieridae] Immature/Adult Guild: Leaf feeder/?

1416 Papilionidae spp. (Swallowtails) [Lepidoptera: Papilionidae] Immature/Adult Guild: Leaf feeder/?

1417 Parnassiidae spp. (Parnassians) [Lepidoptera: Parnassiidae]

1418 Danaidae spp. (Milkweed butterflies) [Lepidoptera: Danaidae] Immature/Adult Guild: Leaf feeder/?

1419 Satyridae spp. (Satyrs,wood nymphs,arctics) [Lepidoptera: Satyridae]

1420 Heliconiidae spp. (Heliconians) [Lepidoptera: Heliconiidae]

1421 Nymphalidae spp. (Brush-footed butterflies) [Lepidoptera: Nymphalidae] Immature/Adult Guild: Leaf feeder/?

1422 Tipulidae spp. (Crane flies) [Diptera: Tipulidae]

1423 Psychodidae spp. (Moth flies and sand flies) [Diptera: Psychodidae]

1424 Ptychopteridae spp. (Phantom crane flies) [Diptera: Ptychopteridae] Immature/Adult Guild: Saprophage/?

1425 Dixidae spp. (Dixid midges) [Diptera: Dixidae]

1426 Chaoboridae spp. (Phantom midges) [Diptera: Chaoboridae] Immature/Adult Guild: Predator/?

1427 Culicidae spp. (Mosquitos) [Diptera: Culicidae] Immature/Adult Guild: ?/Blood feeder

1428 Ceratopogonidae spp. (Biting midges,punkies,no-see-ums) [Diptera: Ceratopogonidae] Immature/Adult Guild: Scavenger/Ectoparasite,blood feeder

1429 Chironomidae spp. (Midges) [Diptera: Chironomidae]

1430 Simuliidae spp. (Black flies or buffalo gnats) [Diptera: Simuliidae] Immature/Adult Guild: ?/Blood feeder

1431 Anispodidae spp. (Wood gnats) [Diptera: Anispodidae] Immature/Adult Guild: Saprophage/?

1432 Bibionidae spp. (March flies) [Diptera: Bibionidae]

1433 Mycetophilidae spp. (Fungus gnats) [Diptera: Mycetophilidae] Immature/Adult Guild: Fungus feeder/Flower feeder

1434 Sciaridae spp. (Dark-winged fungus gnats) [Diptera: Sciaridae] Immature/Adult Guild: Fungus feeder/?

1435 Scatopsidae spp. (Minute black scavenger flies) [Diptera: Scatopsidae] Immature/Adult Guild: Saprophage/?

1436 Cecidomyiidae spp. (Gall midges or gal gnats) [Diptera: Cecidomyiidae] Immature/Adult Guild: Gall former/?

1437 Xylophagidae spp. [Diptera: Xylophagidae]

1438 Xylomyidae spp. [Diptera: Xylomyidae]

1439 Stratiomyiidae spp. (Soldier flies) [Diptera: Stratiomyidae]

1440 Tabanidae spp. (Horse and deer flies) [Diptera: Tabanidae] Immature/Adult Guild: Predator/Blood feeder

1441 Rhagionidae spp. (Snipe flies) [Diptera: Rhagionidae] Immature/Adult Guild: Predator/Predator

1442 Therevidae spp. (Stiletto flies) [Diptera: Therevidae] Immature/Adult Guild: Predator/?

1443 Mydidae spp. (Mydas flies) [Diptera: Mydidae] Immature/Adult Guild: Predator/Predator

1444 Asilidae spp. (Robber flies) [Diptera: Asilidae] Immature/Adult Guild: Predator/Predator

1445 Leptogastridae spp. [Diptera: Leptogastridae]

1446 Bombyliidae spp. (Bee flies) [Diptera: Bombyliidae] Immature/Adult Guild: Ectoparasite/?

1447 Empididae spp. (Dance flies) [Diptera: Empididae]

1448 Dolichopodidae spp. (Long-legged flies) [Diptera: Dolichopodidae] Immature/Adult Guild: ?/Predator

1449 Lonchopteridae spp. (Spear-winged flies) [Diptera: Lonchopteridae] Immature/Adult Guild: Saprophage/?

1450 Phoridae spp. (Humpbacked flies) [Diptera: Phoridae]

1451 Pipunculidae spp. (Big-headed flies) [Diptera: Pipunculidae]

1452 Syrphidae spp. (Syrphids or flower flies) [Diptera: Syrphidae]

1453 Conopidae spp. (Thick-headed flies) [Diptera: Conopidae] Immature/Adult Guild: Endoparasite/?

1454 Micropezidae spp. (Stilt-legged flies) [Diptera: Micropezidae]

1455 Psilidae spp. (Rust flies) [Diptera: Psilidae]

1456 Otitidae spp. (Picture-winged flies) [Diptera: Otitidae]

1457 Platystomatidae spp. (Picture-winged flies) [Diptera: Platystomatidae]

1458 Tephritidae spp. (Fruit flies) [Diptera: Tephritidae]

1459 Coelopidae spp. [Diptera: Coelopidae]

1460 Sepsidae spp. (Black scavenger flies) [Diptera: Sepsidae]

1461 Sciomyzidae spp. (Marsh flies) [Diptera: Sciomyzidae]

1462 Lauxaniidae spp. [Diptera: Lauxaniidae]

1463 Chamaemyiidae spp. (Aphid flies) [Diptera: Chamaemyiidae] Immature/Adult Guild: Predator/?

1464 Piophilidae spp. (Skipper flies) [Diptera: Piophilidae] Immature/Adult Guild: Scavenger/?

1465 Sphaeroceridae spp. (Small dung flies) [Diptera: Sphaeroceridae] Immature/Adult Guild: Scavenger/?

1466 Milichiidae spp. [Diptera: Milichiidae]

1467 Chloropidae spp. [Diptera: Chloropidae]

1468 Agromyzidae spp. (Leafminer flies) [Diptera: Agromyzidae] Immature/Adult Guild: Leaf miner/?

1469 Clusiidae spp. [Diptera: Clusiidae] Immature/Adult Guild: Saprophage/?

1470 Heleomyzidae spp. [Diptera: Heleomyzidae] Immature/Adult Guild: Saprophage/?

1471 Anthomyzidae spp. [Diptera: Anthomyzidae]

1472 Anthomyiidae spp. [Diptera: Anthomyiidae]

1473 Muscidae spp. [Diptera: Muscidae] Immature/Adult Guild: Dung feeder/?

1474 Calliphoridae spp. (Blow flies) [Diptera: Calliphoridae] Immature/Adult Guild: Carrion feeder/?

1475 Sarcophagidae spp. [Diptera: Sarcophagidae]

1476 Tachinidae spp. [Diptera: Tachinidae] Immature/Adult Guild: Endoparasite/?

1477 Argidae spp. (Sawflies) [Hymenoptera: Argidae]

1478 Cimbicidae spp. (Sawflies) [Hymenoptera: Cimbicidae]

1479 Tenthredinidae spp. (Sawflies) [Hymenoptera: Tenthredinidae] Immature/Adult Guild: Leaf feeder/?

1480 Siricidae spp. (Horntails) [Hymenoptera: Siricidae] Immature/Adult Guild: Wood borer/?

1481 Cephidae spp. (Stem sawflies) [Hymenoptera: Cephidae] Immature/Adult Guild: Stem borer/?

1482 Braconidae spp. [Hymenoptera: Braconidae] Immature/Adult Guild: Endoparasite/?

1483 Ichneumonidae spp. (Ichneumons) [Hymenoptera: Ichneumonidae] Immature/Adult Guild: Endoparasite/?

1484 Mymaridae spp. (Fairy flies) [Hymenoptera: Mymaridae]

1485 Trichogrammatidae spp. [Hymenoptera: Trichogrammatidae] Immature/Adult Guild: Egg parasite/?

1486 Eulophidae spp. [Hymenoptera: Eulophidae] Immature/Adult Guild: Parasite/?

1487 Encyrtidae spp. [Hymenoptera: Encyrtidae] Immature/Adult Guild: Parasite/?

1488 Eupelmidae spp. [Hymenoptera: Eupelmidae] Immature/Adult Guild: Parasite/?

1489 Perilampidae spp. [Hymenoptera: Perilampidae] Immature/Adult Guild: Hyperparasite/?

1490 Torymidae spp. [Hymenoptera: Torymidae]

1491 Pteromalidae spp. [Hymenoptera: Pteromalidae]

1492 Eurytomidae spp. (Seed chalcids) [Hymenoptera: Eurytomidae] Immature/Adult Guild: Internal seed feeder/?

1493 Chalcididae spp. [Hymenoptera: Chalcididae] Immature/Adult Guild: Parasite/?

1494 Figitidae spp. [Hymenoptera: Figitidae] Immature/Adult Guild: Parasite/?

1495 Cynipidae spp. (Gall wasps and others) [Hymenoptera: Cynipidae]

1496 Evaniidae spp. (Ensign wasps) [Hymenoptera: Evaniidae] Immature/Adult Guild: Egg parasite/?

1497 Gasteruptiidae spp. [Hymenoptera: Gasteruptiidae] Immature/Adult Guild: Parasite/?

1498 Aulacidae spp. [Hymenoptera: Aulacidae] Immature/Adult Guild: Parasite/?

1499 Pelecinidae spp. [Hymenoptera: Pelecinidae] Immature/Adult Guild: Parasite/?

1500 Proctotrupidae spp. [Hymenoptera: Proctotrupidae] Immature/Adult Guild: Parasite/?

1501 Diapriidae spp. [Hymenoptera: Diapriidae] Immature/Adult Guild: Parasite/?

1502 Scelionidae spp. [Hymenoptera: Scelionidae] Immature/Adult Guild: Parasite/?

1503 Platygasteridae spp. [Hymenoptera: Platygasteridae] Immature/Adult Guild: Parasite/?

1504 Chrysididae spp. [Hymenoptera: Chrysididae] Immature/Adult Guild: Ectoparasite/?

1505 Bethylidae spp. [Hymenoptera: Bethylidae] Immature/Adult Guild: Parasite/?

1506 Dryinidae spp. [Hymenoptera: Dryinidae] Immature/Adult Guild: Endoparasite/?

1507 Tiphiidae spp. [Hymenoptera: Tiphiidae] Immature/Adult Guild: Parasite/?

1508 Mutillidae spp. (Velvet ants) [Hymenoptera: Mutillidae] Immature/Adult Guild: Ectoparasite/?

1509 Scoliidae spp. [Hymenoptera: Scoliidae]

1510 Formicidae spp. (Ants) [Hymenoptera: Formicidae]

1511 Vespidae spp. (Paper wasps and others) [Hymenoptera: Vespidae]

1512 Pompilidae spp. (Spider wasps) [Hymenoptera: Pompilidae]

1513 Sphecidae spp. (Thread-waisted wasps and others) [Hymenoptera: Sphecidae]

1514 Colletidae spp. (Plasterer bees,yellow-faced bees) [Hymenoptera: Colletidae]

1515 Halictidae spp. [Hymenoptera: Halictidae]

1516 Andrenidae spp. [Hymenoptera: Andrenidae]

1517 Megachilidae spp. (Leafcutter bees) [Hymenoptera: Megachilidae]

1518 Anthophoridae spp. (Cuckoo bees,digger bees,carpenter bees) [Hymenoptera: Anthophoridae]

1519 Apidae spp. (Honey and bumble bees) [Hymenoptera: Apidae]

1520 Ephydridae spp. (Shore flies) [Diptera: Ephydridae]

1521 Yponomeutidae spp. (Ermine moths) [Lepidoptera: Yponomeutidae] Immature/Adult Guild: Leaf feeder/?

1522 Aspidiinae spp. [Coleoptera: Mordellidae]

1523 Sphegigastrinae spp. [Hymenoptera: Sphegigastrinae]

1524 Dasytidae spp. [Coleoptera: Dasytidae]

1525 Trixoscelididae spp. [Diptera: Trixoscelididae]

1526 Oelolothripidae spp. [Thysanoptera: Oelolothripidae]

1527 Aphidiinae spp. [Hymenoptera: Braconidae]

1528 Ceraphronidae spp. [Hymenoptera: Ceraphronidae] Immature/Adult Guild: Parasite/?

1529 Cynipoidea spp. [Hymenoptera: Cynipoidea]

1530 Psocidae spp. (Barklice) [Psocoptera: Psocidae]

1531 Eucoilidae spp. [Hymenoptera: Eucoilidae]

1532 Carnidae spp. [Diptera: Carnidae]

1533 [Record Deleted]

1534 Neelidae spp. [Collembola: Neelidae]

1535 Elasmidae spp. [Hymenoptera: Elasmidae]

1536 Thysanidae spp. [Hymenoptera: Thysanidae] Immature/Adult Guild: Parasite/?

1537 Eutrichosomatidae spp. [Hymenoptera: Eutrichosomatidae] Immature/Adult Guild: Parasite/?

1538 Eucharitidae spp. [Hymenoptera: Eucharitidae] Immature/Adult Guild: Pupal parasite/?

1539 Eumenidae spp. [Hymenoptera: Eumenidae]

1540 Microlepidoptera spp. [Lepidoptera: Microlepidoptera]

1541 Oncideres pustulata LeConte (Huisache or mesquite girdler) [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer,girdler/Girdler

1542 Chrysobothris octocola LeConte [Coleoptera: Buprestidae] Oviposition Medium: Bark surfaces

1543 Scobicia declivis (LeConte) (Leadcable borer or short-curcuit beetle) [Coleoptera: Bostrichidae] Immature/Adult Guild: Wood borer/Wood borer

1544 Diplotaxis spp. [Coleoptera: Scarabaeidae]

1545 Eriosoma americanum (Riley) (Woolly elm aphid) [Homoptera: Aphididae]

1546 Datana ministra (Drury) (Yellownecked caterpillar) [Lepidoptera: Notodontidae] Immature/Adult Guild: Defoliator,skeletonizer/? Overwintering Stage: Pupae Oviposition Medium: Leaf undersides Generations Per Year: 1

1547 Nymphalis californica (Boisduval) (California tortoise-shell) [Lepidoptera: Nymphalidae] Immature/Adult Guild: Leaf feeder/?

1548 Orgyia vetusta gulosa Henry Edwards [Lepidoptera: Liparidae] Immature/Adult Guild: Fruit,leaf feeder/?

1549 Chaetophloeus heterodoxus (=Renocis) (Casey) (Mountain mahogany bark beetle) [Coleoptera: Scolytidae] Immature/Adult Guild: Bark beetle/Bark beetle

1550 Serica anthracina LeConte (Manzanita serica) [Coleoptera: Scarabaeidae]

1551 Hemileuca eglanterina (=Pseudohazis) (Boisduval) (Brown day moth,Pacific day moth) [Lepidoptera: Saturniidae] Immature/Adult Guild: Leaf feeder/?

1552 Hyalophora euryalus (Boisduval) (Ceanothus silk moth) [Lepidoptera:

Saturniidae] Immature/Adult Guild: ?/Leaf feeder

1553 Thrips madronii Moulton (Madrona thrips) [Thysanoptera: Thripidae]

1554 Trialeurodes vaporariorum (Westwood) (Greenhouse whitefly) [Homoptera: Aleyrodidae]

1555 Agrilus arbuti Fisher [Coleoptera: Buprestidae] Oviposition Medium: Bark surfaces

1556 Melalgus confertus (LeConte) [Coleoptera: Anobiidae]

1557 Trirhabda nitidicollis LeConte [Coleoptera: Chrysomelidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

1558 Trirhabda pilosa Blake [Coleoptera: Chrysomelidae] Immature/Adult Guild: Leaf feeder/Bud,leaf,twig feeder

1559 Hemileuca hera Harris [Lepidoptera: Saturniidae]

1560 Aroga websteri Clarke (Sagebrush defoliator) [Lepidoptera: Gelechiidae] Immature/Adult Guild: Leaf feeder/?

1561 Dicerca horni Crotch [Coleoptera: Buprestidae] Immature/Adult Guild: Wood borer: dead,injured wood/Bark,leaf feeder Oviposition Medium: Bark surfaces

1562 Chramesus spp. [Coleoptera: Scolytidae]

1563 Hemileuca tricolor Packard [Coleoptera: Saturniidae]

1564 Hylocurus parkinsoniae Blackman [Coleoptera: Scolytidae]

1565 Chaetophloeus fasciatus Blackman [Coleoptera: Scolytidae]

1566 Ethmia discostrigella (Chambers) (Mountain mahogany leaf notcher) [Lepidoptera: Ethmiidae] Immature/Adult Guild: Leaf feeder/? Oviposition Medium: Stem surfaces

1567 Polycesta californica LeConte (California buprestid) [Coleoptera: Buprestidae] Oviposition Medium: Bark surfaces

1568 Vrilletta decorata Van Dyke [Coleoptera: Anobiidae]

1569 Magdalis aenescens LeConte (Bronze apple tree weevil) [Coleoptera: Curculionidae] Immature/Adult Guild: Wood borer: dead,injured wood/? Overwintering Stage: Adults Oviposition Medium: Bark incisions

1570 Eriosoma crataegi (Oestlund) [Homoptera: Aphididae]

1571 Lambdina fiscellaria lugubrosa (Hulst) (Western hemlock looper) [Lepidoptera: Geometridae]

1572 Walshomyia juniperina Felt [Diptera: Cecidomyiidae]

1573 Allassomyia juniperi (Felt) [Diptera: Cecidomyiidae]

1574 Phloeosinus spp. [Coleoptera: Scolytidae]

1575 Phloeosinus furnissi Blackman [Coleoptera: Scolytidae]

1576 Phloeosinus hoferi Blackman [Coleoptera: Scolytidae]

1577 Phloeosinus serratus (LeConte) [Coleoptera: Scolytidae]

1578 Chrysobothris texana LeConte [Coleoptera: Buprestidae] Oviposition Medium: Bark surfaces

1579 Moneilema spp. [Coleoptera: Cerambycidae]

1580 Oxythrips pinicola Hood [Thysanoptera: Thripidae]

1581 Conophthorus edulis Hopkins (Pinyon cone beetle) [Coleoptera: Scolytidae] Immature/Adult Guild: Cone feeder/? Overwintering Stage: Adults Oviposition Medium: Conifer cones

1582 Tricorynus conophilus (Fall) [Coleoptera: Anobiidae]

1583 Chionodes periculella (Busck) [Lepidoptera: Gelechiidae]

1584 Eucosma bobana Kearfott (Pinyon cone moth) [Lepidoptera: Olethreutidae]

1585 Pineus coloradensis (Fitch) (Pine leaf chermid) [Homoptera: Phylloxeridae]

1586 Halisidota argentata subalpina French (Silver-spotted halisidota) [Lepidoptera: Arctiidae]

1587 Halisidota ingens Hy. Edwards [Lepidoptera: Arctiidae]

1588 Contarinia cockerelli (Felt) [Diptera: Cecidomyiidae]

1589 Janetiella coloradensis Felt (Pinyon stunt needle midge) [Diptera: Cecidomyiidae] Immature/Adult Guild: Gall former/? Overwintering Stage: Larvae Oviposition Medium: Conifer needles

1590 Pinyonia edulicola Gagne (Juniper tip or pinyon spindle gall midge) [Diptera: Cecidomyiidae] Immature/Adult Guild: Gall former/? Overwintering Stage: Larvae Oviposition Medium: Conifer needles Generations Per Year: 1

1591 Neodiprion edulicolus Ross (Pinyon sawfly) [Hymenoptera: Diprionidae]

1592 Zadiprion rohweri (Middleton) [Hymenoptera: Diprionidae]

1593 Matsucoccus acalyptus Herbert (Pinyon needle scale) [Homoptera: Margarodidae] Oviposition Medium: Bark crevices

1594 Matsucoccus eduli Morrison [Homoptera: Margarodidae]

1595 Matsucoccus monophyllae McKenzie [Homoptera: Margarodidae]

1596 Okanagana spp. [Homoptera: Cicadidae]

1597 Pityococcus ferrisi McKenzie [Homoptera: Margarodidae]

1598 Pityococcus rugulosus McKenzie [Homoptera: Margarodidae]

1599 Carphoborus pinicolens Wood [Coleoptera: Scolytidae]

1600 Pityophthorus spp. [Coleoptera: Scolytidae]

1601 Conophthorus monophyllae Hopkins (Singleleaf pinyon cone beetle) [Coleoptera: Scolytidae] Immature/Adult Guild: Cone feeder/? Overwintering Stage: Adults Oviposition Medium: Conifer cones

1602 Ernobius montanus Fall [Coleoptera: Anobiidae]

1603 Dioryctria albovittella (Hulst) [Lepidoptera: Pyralidae]

1604 Xyela concava Burdick [Hymenoptera: Xyelidae]

1605 Xyela deserti Burdick [Hymenoptera: Xyelidae]

1606 Glyptoscelis aridis Van Dyke [Coleoptera: Chrysomelidae]

1607 Dendrocoris pini Montandon [Hemiptera: Pentatomidae]

1608 Desmococcus captivus McKenzie [Homoptera: Margarodidae]

1609 Desmococcus sedentarius McKenzie [Homoptera: Margarodidae]

1610 Petrova monophylliana (Kearfott) [Lepidoptera: Olethreutidae] Immature/Adult Guild: Stem borer/?

1611 Dendroctonus ponderosae Hopkins (Black Hills beetle) [Coleoptera: Scolytidae] Overwintering Stage: Adults,larvae Generations Per Year: 1

1612 Ips confusus (LeConte) (Yellow pine engraver) [Coleoptera: Scolytidae] Immature/Adult Guild: Bark beetle/Bark beetle

1613 Haplidus testaceus LeConte [Coleoptera: Cerambycidae]

1614 Oiketicus spp. [Lepidoptera: Psychidae]

1615 Hemileuca juno Packard [Lepidoptera: Saturniidae]

1616 Oncideres rhodosticta Bates (Mesquite girdler) [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer,girdler/Girdler Oviposition Medium: Bark incisions

1617 Megacyllene antennata (White) (Mesquite borer) [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer: dead wood/?

1618 Neoclytus caprea (Say) (Banded ash borer) [Coleoptera: Cerambycidae]

1619 Paraneotermes simplicicornis (Banks) [Isoptera: Kalotermitidae]

1620 Derobrachus geminatus LeConte [Coleoptera: Cerambycidae]

1621 Melissopus latiferrenaus (Walsingham) (Filbertworm) [Lepidoptera: Olethreutidae]

1622 Corythucha padi Drake (Chokecherry tingid) [Hemiptera: Tingidae] Immature/Adult Guild: Sap feeder/Sap feeder

1623 Heterocampa manteo (Doubleday) (Variable oakleaf caterpillar) [Lepidoptera: Notodontidae]

1624 Orgyia spp. [Lepidoptera: Liparidae]

1625 Schizura concinna (J.E. Smith) or (A. & S.) (Redhumped caterpillar) [Lepidoptera: Notodontidae] Overwintering Stage: Pupae in soil Oviposition Medium: Leaf undersides

1626 Xylomyges simplex (Walker) [Lepidoptera: Noctuidae]

1627 Malacosoma disstria Hubner (Forest tent caterpillar) [Lepidoptera: Lasiocampidae] Immature/Adult Guild: Leaf feeder/?

1628 Malacosoma incurvum (Henry Edwards) (Southwestern tent caterpillar) [Lepidoptera: Lasiocampidae] Immature/Adult Guild: Leaf feeder/?

1629 Archips cerasivoranus (Fitch) (Uglynest caterpillar) [Lepidoptera: Tortricidae]

1630 Trichiosoma triangulum Kirby [Hymenoptera: Cimbicidae]

1631 Taenionema pacifica (Banks) [Plecoptera: Nemouridae]

1632 Hyphantria cunea (Drury) (Fall webworm) [Lepidoptera: Arctiidae] Immature/Adult Guild: Leaf feeder/? Overwintering Stage: Pupae Oviposition Medium: Leaf surfaces

1633 Quadraspidiotus perniciosus (Comstock) (San Jose scale) [Homoptera: Diaspididae] Immature/Adult Guild: Sap feeder/Sap feeder

1634 Hemicoelus gibbicollis (LeConte) (Pacific powderpost beetle) [Coleoptera: Anobiidae]

1635 Ptilinus basalis LeConte [Coleoptera: Anobiidae]

1636 Edwardsiana rosae (Linnaeus) (Rose leafhopper) [Homoptera: Cicadellidae]

1637 Hemileuca nuttalli Strecker [Lepidoptera: Saturniidae]

1638 Orgyia antiqua (Linnaeus) (Rusty tussock moth) [Lepidoptera: Liparidae]

1639 Lithocolletis umbellulariae Walsingham (Aspen blotchminer) [Lepidoptera: Gracilariidae]

1640 Hylocurus hirtellus (LeConte) (Shrub bark beetle) [Coleoptera: Scolytidae] Immature/Adult Guild: Bark beetle/Bark beetle

1641 Holopleura marginata LeConte [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer: dead wood/?

1642 Pseudopityophthorus spp. [Coleoptera: Scolytidae]

1643 Lyctus spp. [Coleoptera: Lyctidae]

1644 Polycaon stoutii (LeConte) (Stout's branch borer) [Coleoptera: Bostrichidae] Immature/Adult Guild: Wood borer/?

1645 Rosalia funebris Motschulsky (Banded alder or California laurel borer) [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

1646 Amelia pallorana (Rob.) [Lepidoptera: Family?]

1647 Rhagoletis cingulata (Loew) (White-banded cherry fruit fly) [Diptera: Tephritidae]

1648 Amphorophora nervata (Gill) [Homoptera: Aphididae]

1649 Amphorophora sonchi (Oestlund) [Homoptera: Aphididae]

1650 Aphis helichrysi (Kalt.) (Leaf curl plum aphid) [Homoptera: Aphididae]

1651 Aphis rumicis Linnaeus (Bean or dock aphid) [Homoptera: Aphididae]

1652 Aphis pruni W. & D. [Homoptera: Aphididae]

1653 Capitophorus wasatchii Knowlton [Homoptera: Aphididae]

1654 Macrosiphum solanifolii (Ashmead) [Homoptera: Aphididae]

1655 Periphyllus lyropictus (Kessler) [Homoptera: Aphididae]

1656 Phorodon humuli (Schrank) (Hops aphid) [Homoptera: Aphididae]

1657 Pterocomma bicolor (Oestlund) [Homoptera: Aphididae]

1658 Rhopalosiphum berberidis (Kalt.) [Homoptera: Aphididae]

1659 Rhopalosiphum conii (Davidson) [Homoptera: Aphididae]

1660 Aeolopus arizonensis Scudder [Orthoptera: Acrididae]

1661 Melanoplus differentialis (Thomas) (Differential grasshopper) [Orthoptera: Acrididae]

1662 Schistocerca shoshone (Thomas) (Green bird or green bush grasshopper) [Orthoptera: Acrididae] Immature/Adult Guild: Leaf feeder/Leaf feeder

1663 Schistocerca vaga (Scudder) (Grey bird or vagrant grasshopper) [Orthoptera: Acrididae] Immature/Adult Guild: Leaf feeder/Leaf feeder

1664 Diapheromera arizonensis (Caudell) (Arizona walkingstick) [Orthoptera: Phasmatidae]

1665 Mozena spp. [Hemiptera: Coreidae]

1666 Nysius ericae (Schilling)Auctorum (False chinch bug) [Hemiptera: Lygaeidae]

1667 Lygus lineolaris (Palisot deBeauvois) (Tarnished plant bug) [Hemiptera: Miridae] Immature/Adult Guild: Bud,seed feeder/Bud,seed feeder

1668 Brochymena sulcata Van Duzee (Rough stink bug) [Hemiptera: Pentatomidae] Immature/Adult Guild: Predator/Predator

1669 Chlorochroa ligata (Say) (Concheula) [Hemiptera: Pentatomidae]

1670 Euryopthalmus convivus Stal (Bordered plant bug) [Hemiptera: Pyrrhocoridae]

1671 Zelus renardii Kolen (Leafhopper assassin bug) [Hemiptera: Reduviidae] Immature/Adult Guild: Predator/Predator

1672 Apiomerus crassipes (Fabricius) (Bee assassin) [Hemiptera: Reduviidae]

1673 Aphis medicaginis Koch (Cowpea or bur clover aphid) [Homoptera: Aphididae] Overwintering Stage: Adults on alternate host

1674 Macrosiphum pisi (Harr.) (Pea aphid) [Homoptera: Aphididae]

1675 Myzus persicae (Sulzer) (Green peach aphid) [Homoptera: Aphididae]

1676 Empoasca abrupta DeLong (Leafhopper) [Homoptera: Cicadellidae]

1677 Homolodisca liturata Ball (Leafhopper) [Homoptera: Cicadellidae]

1678 Diceroprocta apache Davis (Apache cicada) [Homoptera: Cicadidae] Immature/Adult Guild: Root feeder/Oviposition damage

1679 Oecleus decens Stal [Homoptera: Cixiidae]

1680 Chionaspis etrusca Leonard (Tamarisk scale) [Homoptera: Diaspididae]

1681 Ormenis yumana Ball [Homoptera: Flatidae]

1682 Paratrioza cockerelli (Sulc) (Potato psyllid) [Homoptera: Psyllidae]

1683 Camponotus spp. [Hymenoptera: Formicidae]

1684 Formica perpilosa Wheeler [Hymenoptera: Formicidae]

1685 Pepsis chrysothemis Lucas [Hymenoptera: Pompilidae]

1686 Scolia ardens Smith [Hymenoptera: Scoliidae]

1687 Campsomeris tolteca Saussure [Hymenoptera: Scoliidae]

1688 Campsomeris pollinifera Vier. [Hymenoptera: Scoliidae]

1689 Sphecius speciosus Vier. (Cicada killer) [Hymenoptera: Sphecidae]

1690 Chrysobothris strofasciata Leconte [Coleoptera: Buprestidae] Oviposition Medium: Bark surfaces

1691 Chaetocnema ectypa Horn (Desert corn flea beetle) [Coleoptera: Chrysomelidae]

1692 Chilocorus cacti Linnaeus [Coleoptera: Coccinellidae]

1693 Sandalus californicus Lac. [Coleoptera: Rhipiceridae]

1694 Cotinus arizonensis Casey [Coleoptera: Scarabaeidae]

1695 Ochsosidia arizonica Casey [Coleoptera: Scarabaeidae]

1696 Estigmene acrea (Drury) (Salt-marsh caterpillar or acraea moth) [Lepidoptera: Arctiidae] Immature/Adult Guild: Leaf feeder/?

1697 Papilio rutulus Boisduvall (Western swallowtail) [Lepidoptera: Papilionidae]

1698 Basilarchia obsoleta (Edwards) [Lepidoptera: Nymphalidae]

1699 Colias philodice eurytheme Boisduvall (Alfalfa caterpillar) [Lepidoptera: Pieridae]

1700 Tabanus punctifer Osten Sacken (Big black or western horse fly) [Diptera: Tabanidae] Immature/Adult Guild: Saprophage/Blood feeder

1701 Melanoplus mexicanus mexicanus (Sauss.) (Lesser migratory grasshopper) [Orthoptera: Acrididae]

1702 Micracis hirtellus LeConte (Shrub bark beetle) [Coleoptera: Scolytidae]

1703 Colladonus geminatus (Van Duzee) (Geminate leafhopper) [Homoptera: Cicadellidae] Immature/Adult Guild: Plant disease vector/Plant disease vector

1704 Anaphothrips zeae Moulton (Corn thrips) [Thysanoptera: Thripidae]

1705 Frankliniella gossypiana Hood [Thysanoptera: Thripidae]

1706 Haplothrips fasciculatus (Crawford) [Thysanoptera: Phlaeothripidae]

1707 Haplothrips purpuratus Hood [Thysanoptera: Phlaeothripidae]

1708 Heterothrips prosopidis Crawford [Thysanoptera: Heterothripidae]

1709 Psilothrips paradalotus Hood [Thysanoptera: Thripidae]

1710 Psilothrips priesneri (Moulton) [Thysanoptera: Family?]

1711 Didasia opuntiae Cockerell [Hymenoptera: Family?]

1712 Didasia rinconis Cockerell [Hymenoptera: Family?]

1713 Didasia spp. [Hymenoptera: Family?]

1714 Melissodes spp. [Hymenoptera: Anthophoridae]

1715 Agapostemon melliventris Cresson [Hymenoptera: Halictidae]

1716 Augochlorella pomoniella (Cockerell) [Hymenoptera: Halictidae]

1717 Halictus spp. [Hymenoptera: Halictidae]

1718 Perdita spp. [Hymenoptera: Andrenidae]

1719 Melanoplus bilituratus (Walker) (Migratory or pale-spotted grasshopper) [Orthoptera: Acrididae] Immature/Adult Guild: Leaf feeder/Leaf feeder

1720 Aulocara elliotti (Thomas) (Elliott's or big-headed grasshopper) [Orthoptera: Acrididae]

1721 Melanoplus cuneatus (Gurney) [Orthoptera: Acrididae]

1722 Exema globensis Pierce [Coleoptera: Chrysomelidae]

1723 Luperodes melanolomatus Blake [Coleoptera: Chrysomelidae]

1724 Microrhopala rubrolineata (Mann.) [Coleoptera: Chrysomelidae] Immature/Adult Guild: ?/Leaf feeder

1725 Oedionychus spp. [Coleoptera: Chrysomelidae]

1726 Plagiomorpha arizonae (Crotch) [Coleoptera: Chrysomelidae]

1727 Saxinis scutellaris Schffr. [Coleoptera: Chrysomelidae]

1728 Trichodes ornatus Say (Common checkered beetle) [Coleoptera: Chrysomelidae] Immature/Adult Guild: Predator/Pollen feeder

1729 Hyperaspis bensonica Casey [Coleoptera: Coccinellidae]

1730 Lindorus lophanthae (Blaisdell) (Blaidell's ladybird beetle) [Coleoptera: Coccinellidae] Immature/Adult Guild: Predator/Predator

1731 Scymnus apacheanus Casey [Coleoptera: Coccinellidae]

1732 Anthonomus mimicanus Fall [Coleoptera: Curculionidae]

1733 Brachyogmus ornatus Linell [Coleoptera: Curculionidae]

1734 Tychius setosus LeConte [Coleoptera: Curculionidae]

1735 Cryptorhopalum apicale Mann. [Coleoptera: Dermestidae]

1736 Epicauta caviceps Horn [Coleoptera: Meloidae]

1737 Epicauta wheeleri Horn [Coleoptera: Meloidae]

1738 Lytta auriculata Horn [Coleoptera: Meloidae]

1739 Cybocephalus spp. [Coleoptera: Nitidulidae]

1740 Evarestoides acutangula (Thoms.) [Diptera: Tephritidae]

1741 Trupanea stigmatica (Coq.) [Diptera: Tephritidae]

1742 Geocoris punctipes (Say) (Big-eyed bug) [Hemiptera: Lygaeidae] Immature/Adult Guild: Predator/Predator

1743 Lygaeus analis Dall. [Hemiptera: Lygaeidae]

1744 Nysius monticola Dist. [Hemiptera: Lygaeidae]

1745 Halticotoma valida Reut. [Hemiptera: Miridae]

1746 Neurocolpus arizonae Knight [Hemiptera: Miridae]

1747 Parthenicus baccharidis Knight [Hemiptera: Miridae]

1748 Phytocoris vividus (Uhler) [Hemiptera: Miridae]

1749 Rhinacloa forticornis Reuter [Hemiptera: Miridae] Immature/Adult Guild: Leaf,stem feeder/Leaf,stem feeder

1750 Tuponia spp. [Hemiptera: Miridae]

1751 Corimelaena incognita (McA. & M.) [Hemiptera: Pentatomidae]

1752 Thyanta brevis Van Duzee (Small stink bug) [Hemiptera: Pentatomidae]

1753 Piesma rugulosa McA. [Hemiptera: Piesmatidae]

1754 Zelus socius Uhler (Leafhopper assassin bug) [Hemiptera: Reduviidae] Immature/Adult Guild: Predator/Predator

1755 Aleuroplatus ovatus Q. & B. [Homoptera: Aleyrodidae]

1756 Clastoptera arizonana Doering [Homoptera: Cercopidae]

1757 Diaspis echinocacti (Bouche) (Cactus scale) [Homoptera: Diaspididae] Immature/Adult Guild: Sap feeder/Sap feeder

1758 Lichtensia lycii Cockerell [Homoptera: Coccoidea]

1759 Orthezia annae Cockerell [Homoptera: Ortheziidae]

1760 Pseudodiaspis yuccae (Cockerell) (Celtis scale) [Homoptera: Coccoidea]

1761 Puto lasiorum (Cockerell) [Homoptera: Coccoidea]

1762 Tachardiella fulgens (Cockerell) [Homoptera: Lacciferidae]

1763 Catolaccus victoria Burks [Hymenoptera: Pteromalidae]

1764 Derostenus agromyzae Crawford [Hymenoptera: Eulophidae]

1765 Encarsia meritoria Gahan [Hymenoptera: Eulophidae]

1766 Eretmocerus haldemani Howard [Hymenoptera: Eulophidae]

1767 Hadrotettix trifasciatus (Say) [Orthoptera: Acrididae]

1768 Malacosoma spp. [Lepidoptera: Lasiocampidae] Immature/Adult Guild: Leaf feeder/?

1769 Phytophaga spp. (=Mayetiola) (Bitterbrush seed midges) [Diptera: Cecidomyiidae] Immature/Adult Guild: Internal seed feeder/?

1770 Telenomus utahensis Ashmead [Hymenoptera: Scelionidae]

1771 Psylla spp. [Homoptera: Psyllidae]

1772 Aprostocetus spp. [Hymenoptera: Eulophidae]

1773 Spanogonicus albofasciatus (Reuter) (Black fleahopper) [Hemiptera: Miridae]

1774 Drepanopterna femoratum Scudder [Orthoptera: Acrididae]

1775 Cordillacris crenulata pima Rehn [Orthoptera: Acrididae]

1776 Xanthippus corallipes corallipes (Haldeman) [Orthoptera: Acrididae]

1777 Malacosoma californicum fragile (Stretch) (Great basin tent caterpillar) [Lepidoptera: Lasiocampidae] Immature/Adult Guild: Leaf feeder/?

1778 Melanoplus infantilis Scudder [Orthoptera: Acrididae]

1779 Amphitornus coloradus (Thomas) [Orthoptera: Acrididae]

1780 Melanoplus packardii Scudder (Packard's grasshopper) [Orthoptera: Acrididae]

1781 Ageneotettix deorum (Scudder) [Orthoptera: Acrididae]

1782 Hyles lineata (Fabricius) (Whitelined sphinx moth) [Lepidoptera: Sphingidae]

1783 Pseudococcus spp. (Mealybugs) [Homoptera: Pseudococcidae]

1784 Agrilus spp. (Twig girdlers) [Coleoptera: Buprestidae] Immature/Adult Guild: Wood borer/Bark,leaf feeder Oviposition Medium: Bark surfaces

1785 Sarata incanella (Hulst) [Lepidoptera: Pyralidae]

1786 Eucosma ridingsana [Lepidoptera: Olethreutidae]

1787 Malacosoma fragilis (Stretch) (Great Basin tent caterpillar) [Lepidoptera: Lasiocampidae] Immature/Adult Guild: Leaf feeder/? Overwintering Stage: Eggs Oviposition Medium: Twig surfaces

1788 Chionaspis ortholobis Comstock (Cottonwood scale) [Homoptera: Diaspididae]

1789 Eleodes hispilabris [Coleoptera: Tenebrionidae]

1790 Pelecyphorus densicollis Horn [Coleoptera: Tenebrionidae]

1791 Eusattus muricatus [Coleoptera: Tenebrionidae]

1792 Calosoma luxatum [Coleoptera: Carabidae]

1793 Pogonomyrmex owyheei Cole (Owyhee harvester ant) [Hymenoptera: Formicidae] Immature/Adult Guild: ?/Defoliator,seed eater

1794 Melipotis indomita (Walker) (Cutworm) [Lepidoptera: Noctuidae]

1795 Arphia pseudonietana Scudder [Orthoptera: Acrididae]

1796 Encoptolophus sordidus costalis (Scudder) [Orthoptera: Acrididae]

1797 Eritettix simplex tricarinatus (Thomas) [Orthoptera: Acrididae]

1798 Phlibostroma quadrimaculatum (Thomas) [Orthoptera: Acrididae]

1799 Psoloessa delicatula delicatula (Scudder) [Orthoptera: Acrididae]

1800 Trachyrhachys kiowa (Thomas) [Orthoptera: Acrididae]

1801 Trimerotropis campestris McNeill [Orthoptera: Acrididae]

1802 Trimerotropis gracilis sordida (Walker) [Orthoptera: Acrididae]

1803 Xanthippus corallipes buckelli (Hebard) [Orthoptera: Acrididae]

1804 Tricorymus extremus White [Coleoptera: Anobiidae]

1805 Acmaeodera gibbula LeConte [Coleoptera: Buprestidae] Oviposition Medium: Bark surfaces

1806 Chrysobothris acaciae Knull [Coleoptera: Buprestidae] Oviposition Medium: Bark surfaces

1807 Chrysobothris exesa LeConte [Coleoptera: Buprestidae] Immature/Adult Guild: Wood borer/? Oviposition Medium: Bark surfaces

1808 Chrysobothris lateralis Waterhouse [Coleoptera: Buprestidae] Oviposition Medium: Bark surfaces

1809 Chrysobothris purpleovittata Horn [Coleoptera: Buprestidae] Oviposition Medium: Bark surfaces

1810 Chrysobothris rossi Van Dyke [Coleoptera: Buprestidae] Oviposition Medium: Bark surfaces

1811 Hippopsis spp. [Coleoptera: Cerambycidae]

1812 Taranomis bivittata (Dupont) [Coleoptera: Cerambycidae]

1813 Amphicerus bicaudatus (Say) (Apple twig borer) [Coleoptera: Bostrichidae]

1814 Apatides fortis (LeConte) [Coleoptera: Bostrichidae] Immature/Adult Guild: Wood borer: dead wood/?

1815 Xyloblaptus quadrispinosus (LeConte) [Coleoptera: Bostrichidae]

1816 Trogoxylon parallelopipedum (Melsheimer) [Coleoptera: Lyctidae]

1817 Oryzaephilus surinamensis (Linnaeus) (Saw-toothed grain beetle) [Coleoptera: Cucujidae]

1818 Cordillacris occipitalis (Thomas) [Orthoptera: Acrididae]

1819 Melanoplus angustipennis (Dodge) [Orthoptera: Acrididae]

1820 Melanoplus confusus (Scudder) [Orthoptera: Acrididae]

1821 Mermiria maculipennis [Orthoptera: Acrididae]

1822 Pardalophora apiculata [Orthoptera: Acrididae]

1823 Spharagemon collare (Scudder) (Utah locust) [Orthoptera: Acrididae]

1824 Acanthoscelides collusus (Fall) [Coleoptera: Bruchidae]

1825 Algarobius bottimeri Kingsolver [Coleoptera: Bruchidae]

1826 Gnathamitermes tubiformans (Buckley) [Isoptera: Termitidae]

1827 Hemileuca oliviae Cockerell (New Mexico range caterpillar) [Lepidoptera: Saturniidae]

1828 Podosesia syringe syringe (Harris) (Lilac borer) [Lepidoptera: Sesiidae] Immature/Adult Guild: Wood borer/?

1829 Urophora formosa Coquillet [Diptera: Tephritidae]

1830 Trupanea femoralis Thompson [Diptera: Tephritidae]

1831 Paroxyna murina Doane [Diptera: Tephritidae]

1832 Sophronia spp [Lepidoptera: Gelechiidae]

1833 Nysius californicus Stal (Calfornia false chinch bug) [Hemiptera: Lygaeidae]

1834 Bootettix punctatus Sc. (Creosote bush grasshopper) [Orthoptera: Acrididae]

1835 Arenivaga investigata (Desert cockroach) [Orthoptera: Polyphagidae]

1836 Pogonomyrmex californicus (Buckley) (California harvester ant) [Hymenoptera: Formicidae]

1837 Melanoplus arizonae [Orthoptera: Acrididae]

1838 Melanoplus lakinus (Scudder) [Orthoptera: Acrididae]

1839 Dactylotum variegatum [Orthoptera: Acrididae]

1840 Eritettix varabilis [Orthoptera: Acrididae]

1841 Anthicus spp. [Coleoptera: Anthicidae]

1842 Philophuga amoena LeConte [Coleoptera: Carabidae]

1843 Callisthenes striatulus LeConte [Coleoptera: Carabidae]

1844 Hydnocera subfasciata LeConte [Coleoptera: Cleridae]

1845 Epitrix spp. [Coleoptera: Chrysomelidae]

1846 Microrhopala spp. [Coleoptera: Chrysomelidae]

1847 Monoxia guttulata LeConte [Coleoptera: Chrysomelidae]

1848 Monoxia sordida (LeConte) [Coleoptera: Chrysomelidae]

1849 Pachybrachis melanostictus Suffrian [Coleoptera: Chrysomelidae]

1850 Pachybrachis peccans Suff. [Coleoptera: Chrysomelidae]

1851 Phyllotreta albionica LeConte (Colorado cabbage flea beetle) [Coleoptera: Chrysomelidae]

1852 Scelolyperus longulus (LeConte) [Coleoptera: Chrysomelidae]

1853 Systena taeniata (LeConte) (Banded flea beetle) [Coleoptera: Chrysomelidae] Immature/Adult Guild: Root feeder/Leaf feeder

1854 Adalia frigida humeralis (Say) (Frigid ladybird beetle) [Coleoptera: Coccinellidae]

1855 Brachyacantha dentipes socialis Casey [Coleoptera: Coccinellidae]

1856 Coccinella spp. [Coleoptera: Coccinellidae]

1857 Coccinella monticola difficilis Casey [Coleoptera: Coccinellidae]

1858 Coccinella novemnotata degener Casey [Coleoptera: Coccinellidae]

1859 Exochomus marginipennis californicus Casey (Variable ladybird beetle) [Coleoptera: Coccinellidae] Immature/Adult Guild: Predator/Predator

1860 Exochomus septentrionis parvicollis Casey [Coleoptera: Coccinellidae]

1861 Hippodamia convergens ambigus LeConte [Coleoptera: Coccinellidae]

1862 Hippodamia lecontei Mulsant (LeConte's ladybird beetle) [Coleoptera: Coccinellidae] Immature/Adult Guild: Predator/Predator

1863 Hippodamia lunatomaculata apicalis Casey [Coleoptera: Coccinellidae] Immature/Adult Guild: Predator/Predator

1864 Hyperaspis chapins Dobz. [Coleoptera: Coccinellidae]

1865 Hyperaspis dissoluta Cresson [Coleoptera: Coccinellidae]

1866 Hyperaspis lateralis montanica Casey [Coleoptera: Coccinellidae]

1867 Hyperaspis spiculinota Fallen [Coleoptera: Coccinellidae]

1868 Hyperaspis taeniata nevadica Csy. [Coleoptera: Coccinellidae]

1869 Hyperaspis taeniata taeniata Lec. [Coleoptera: Coccinellidae]

1870 Scymnus weidti Casey [Coleoptera: Coccinellidae]

1871 Allandrus bifasciatus LeConte [Coleoptera: Curculionidae]

1872 Anthonomus albopilosus Dietz. [Coleoptera: Curculionidae]

1873 Anthonomus sphaeralceae Fall [Coleoptera: Curculionidae]

1874 Desmoris fulvus LeConte [Coleoptera: Curculionidae]

1875 Anthonomus cycliferus Fall [Coleoptera: Curculionidae]

1876 Ludius inflatus (Say) (Inflated wireworm) [Coleoptera: Elateridae] Immature/Adult Guild: Seedling,root feeder/Bud,flower feeder

1877 Pheletes canus LeConte [Coleoptera: Elateridae]

1878 Saprinus scabriceps Casey [Coleoptera: Histeridae]

1879 Attalus nigripes Hom. [Coleoptera: Melyridae]

1880 Entrichopleurus sesiellus (Casey) [Coleoptera: Melyridae]

1881 Listus rubripes LeConte [Coleoptera: Melyridae]

1882 Vectura albicans Casey [Coleoptera: Melyridae]

1883 Pocalto grandicollis Hald. [Coleoptera: Scarabaeidae]

1884 Hylocrinus spp. [Coleoptera: Tenebrionidae]

1885 Haplomyza spp. [Diptera: Agromyzidae]

1886 Phytomyza atricornis Mg. [Diptera: Agromyzidae]

1887 Bibio albipennis tenuipes Coq. [Diptera: Agromyzidae]

1888 Phormia regina (Meigen) (Black blow fly) [Diptera: Calliphoridae]

1889 Pollenia rudis (Fabricius) (Cluster fly) [Diptera: Calliphoridae]

1890 Chamaemyia spp. [Diptera: Chamaemyiidae]

1891 Madiza neglecta (Beck) [Diptera: Milichiidae]

1892 Oscinella frit nitidissima (Mg.) [Diptera: Chloropidae]

1893 Tomosvaryella spp. [Diptera: Pipunculidae]

1894 Culicoides crepuscularis Malloch [Diptera: Ceratopogonidae]

1895 Asteromyia spp. [Diptera: Cecidomyiidae]

1896 Janetiella spp. [Diptera: Cecidomyiidae]

1897 Rhopalomyia tridentatae Rubsaaemen [Diptera: Cecidomyiidae] Immature/Adult Guild: Gall former/?

1898 Madremyia saundersii (Will.) [Diptera: Tachinidae]

1899 Nemorilla floralis (Fallen) [Diptera: Tachinidae]

1900 Polideosoma cinerosa (Coq.) [Diptera: Tachinidae]

1901 Samacia spp. [Diptera: Tachinidae]

1902 Madiza halteralis (Coq.) [Diptera: Milichiidae]

1903 Fannia spp. [Diptera: Muscidae]

1904 Omphrale nubilipes (Say) [Diptera: Scenopinidae]

1905 Geosargus viridis (Say) [Diptera: Stratiomyidae]

1906 Tendipes plumosus (Linnaeus) [Diptera: Chironomidae]

1907 Tendipes utahensis Malloch [Diptera: Chironomidae]

1908 Eutreta facialis Curran (Gall forming fruit flies) [Diptera: Tephritidae] Immature/Adult Guild: Gall former/Gall former

1909 Oxyna palpalis (Coq.) [Diptera: Tephritidae]

1910 Procecidochares minuta Snow (Gall forming fruit flies) [Diptera: Tephritidae] Immature/Adult Guild: Gall former/Gall former

1911 Trupanea bisetosa (Coquillett) [Diptera: Tephritidae]

1912 Trupanea radifera Coq. [Diptera: Tephritidae]

1913 Eutreta nr. jonesi Curran (Gall forming fruit flies) [Diptera: Tephritidae] Immature/Adult Guild: Gall former/Gall former

1914 Thereva furcata Loew [Diptera: Therevidae]

1915 Leptocoris trivittatus (Say) (Box elder bug) [Hemiptera: Coreidae]

1916 Stictopleurus pallidus (Baker) [Hemiptera: Coreidae]

1917 Stictopleurus plutonius (Baker) [Hemiptera: Coreidae]

1918 Lygaeus kalmii Stal (Common milkweed bug) [Hemiptera: Lygaeidae]

1919 Nysius raphanus Howard [Hemiptera: Lygaeidae] Immature/Adult Guild: Leaf,stem feeder/Leaf,stem feeder

1920 Nysius tenellus Barber [Hemiptera: Lygaeidae]

1921 Chlamydatus uniformis (Uhler) [Hemiptera: Miridae]

1922 Deraeocoris brevis piceatus Knight [Hemiptera: Miridae]

1923 Europiella decolor (Uhler) [Hemiptera: Miridae]

1924 Labopidea sericata (Uhler) [Hemiptera: Miridae]

1925 Lopidea bullata Knight [Hemiptera: Miridae]

1926 Melanotrichus inconspicuus (Uhler) [Hemiptera: Miridae]

1927 Melanotrichus spp. [Hemiptera: Miridae]

1928 Parthenicus spp. [Hemiptera: Miridae] Immature/Adult Guild: Leaf feeder/Leaf feeder

1929 Phyllopidea spp. [Hemiptera: Miridae]

1930 Psallus spp. [Hemiptera: Miridae]

1931 Strongylocoris robustus (Uhler) [Hemiptera: Miridae]

1932 Jalysus wickhami Van Duzee [Hemiptera: Berytidae]

1933 Elasmostethus cruciatus (Say) [Hemiptera: Pentatomidae]

1934 Homaemus aeneifrons extensus Wally (Black-faced shield bug) [Hemiptera: Scutelleridae]

1935 Thyanta pallidovirens (Stal) [Hemiptera: Pentatomidae] Immature/Adult Guild: Leaf,stem feeder/Leaf,stem feeder

1936 Sinea anacantha Hussy [Hemiptera: Reduviidae]

1937 Clastoptera brunnea Ball [Homoptera: Aphididae]

1938 Aceratagallia fuscoscripta Oman [Homoptera: Cicadellidae]

1939 Acinopterus spp. [Homoptera: Cicadellidae]

1940 Circulifer tenellus (Baker) (Sugar beet leafhopper) [Homoptera: Cicadellidae] Immature/Adult Guild: Sap feeder/Sap feeder

1941 Deltocephalus grex Oman [Homoptera: Cicadellidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

1942 Dikraneura carneola (Stal) [Homoptera: Cicadellidae]

1943 Dikraneura spp. [Homoptera: Cicadellidae]

1944 Empoasca decora DeLong & Davidson [Homoptera: Cicadellidae]

1945 Empoasca nigra G. & B. [Homoptera: Cicadellidae]

1946 Psammotettix dentatus Knull [Homoptera: Cicadellidae]

1947 Scleroracus spp. [Homoptera: Cicadellidae]

1948 Stragania atra (Baker) [Homoptera: Cicadellidae]

1949 Okanagana striatipes Hald. [Homoptera: Cicadidae]

1950 Olicarus dondonius Ball [Homoptera: Cixiidae]

1951 Haplaxius spp. [Homoptera: Cixiidae]

1952 Delphacodes propinqua (Fieb.) [Homoptera: Delphacidae]

1953 Scolops pallidus Uhler (Pallid scolops) [Homoptera: Dictyopharidae] Immature/Adult Guild: Stem feeder/Stem feeder

1954 Hysteropterum cornutum uthanum Ball [Homoptera: Issidae]

1955 Anisostylus stylus Cald. [Homoptera: Membracidae]

1956 Neophilaenus lineatus (Linnaeus) [Homoptera: Cercopidae]

1957 Campylenchia latipes Say [Homoptera: Membracidae]

1958 Tortistilus wickhami Van Duzee [Homoptera: Membracidae]

1959 Enchenopa permutata Van Duzee [Homoptera: Membracidae]

1960 Psylla ribesiae Crawford [Homoptera: Psyllidae]

1961 Psylla coryli Patch [Homoptera: Psyllidae]

1962 Pachypsylla venusta Osten Sacken [Homoptera: Psyllidae]

1963 Aphalara pinicola Crawford [Homoptera: Psyllidae]

1964 Aphalara angustipennis Crawford [Homoptera: Psyllidae]

1965 Andrena spp. [Hymenoptera: Andrenidae]

1966 Anisepyris spp. [Hymenoptera: Bethylidae]

1967 Epyris spp. [Hymenoptera: Bethylidae]

1968 Apanteles feltiae Vier. [Hymenoptera: Braconidae]

1969 Lysiphlebus spp. [Hymenoptera: Braconidae]

1970 Bracon pygmaeus Prov. [Hymenoptera: Braconidae]

1971 Dacnusa spp. [Hymenoptera: Braconidae]

1972 Opius spp. [Hymenoptera: Braconidae]

1973 Rhysipolis spp. [Hymenoptera: Braconidae]

1974 Rogas stigmator Say [Hymenoptera: Braconidae]

1975 Tetrasphaeropyx spp. [Hymenoptera: Braconidae]

1976 Praon artemisaphis Smith [Hymenoptera: Braconidae]

1977 Spilochalcis albifrons (Walsh) [Hymenoptera: Chalcididae]

1978 Chalcaspis arizonensis Grlt. [Hymenoptera: Encyrtidae]

1979 Mirini spp. [Hymenoptera: Encyrtidae]

1980 Psilogaster spp. [Hymenoptera: Eucharitidae]

1981 Emersonopsis spp. [Hymenoptera: Eulophidae]

1982 Euderus subopacus (Gahan) [Hymenoptera: Eulophidae]

1983 Sympiesis spp. [Hymenoptera: Eulophidae]

1984 Tetrastichus melanis Burks [Hymenoptera: Eulophidae]

1985 Horogenes spp. [Hymenoptera: Ichneumonidae]

1986 Phaeogenes spp. [Hymenoptera: Ichneumonidae]

1987 Ectopius spp. [Hymenoptera: Ichneumonidae]

1988 Scambus bicoloripes (Ashmead) [Hymenoptera: Ichneumonidae]

1989 Pseudomethoca athamas (Fox) [Hymenoptera: Mutillidae]

1990 Perilampus capitatus Smulyan [Hymenoptera: Perilampidae]

1991 Inostemma spp. [Hymenoptera: Platygasteridae]

1992 Leptacis spp. [Hymenoptera: Platygasteridae]

1993 Catolaccus aeneoviridis (Girault) [Hymenoptera: Pteromalidae]

1994 Eunotus spp. [Hymenoptera: Pteromalidae]

1995 Merisinae spp. [Hymenoptera: Pteromalidae]

1996 Pteromalinae spp. [Hymenoptera: Pteromalidae]

1997 Halticoptera spp. [Hymenoptera: Pteromalidae]

1998 Zatropis spp. [Hymenoptera: Pteromalidae]

1999 Scelio spp. [Hymenoptera: Scelionidae]

2000 Passaloecus annulatus (Say) [Hymenoptera: Sphecidae]

2001 Sphex pilosus Fern. [Hymenoptera: Sphecidae]

2002 Paratiphia spp. [Hymenoptera: Tiphiidae]

2003 Torymus spp. [Hymenoptera: Torymidae]

2004 Melanoplus complanatipes [Orthoptera: Acrididae]

2005 Oecanthus nigricornis Walker [Orthoptera: Gryllidae]

2006 Thiodia spp. [Lepidoptera: Olethreutidae]

2007 Bucculatrix spp. [Lepidoptera: Lyonetiidae] Immature/Adult Guild: Leaf feeder/?

2008 Gelechia anarsiella [Lepidoptera: Gelechiidae]

2009 Periphyllus americanus (Baker) (American maple aphid) [Homoptera: Aphididae]

2010 Periphyllus brevispinosus Gillette & Palmer (Colorado maple aphid) [Homoptera: Aphididae]

2011 Drepanaphis idahoensis Smith & Dillery (Idaho maple aphid) [Homoptera: Aphididae]

2012 Drepanaphis kansensis Smith [Homoptera: Aphididae]

2013 Drepanaphis knowltoni Smith & Dillery [Homoptera: Aphididae]

2014 Nearctaphis sensoriata Gillette & Bragg [Homoptera: Aphididae]

2015 Prociphilus caryae (Fitch) [Homoptera: Aphididae]

2016 Acyrthosiphon macrosiphum (Wilson) (Long-legged serviceberry aphid) [Homoptera: Aphididae]

2017 Prociphilus caryae fitchii Baker & Davidson [Homoptera: Aphididae]

2018 Prociphilus corrugatans (Sirrine) [Homoptera: Aphididae]

2019 Tamalia coweni (Cockerell) (Manzanita leaf gall aphid) [Homoptera: Aphididae]

2020 Pleotrichophorus glandulosa (Kaltenbach) [Homoptera: Aphididae]

2021 Pleotrichophorus zoomontanus (Knowlton & Smith) [Homoptera: Aphididae]

2022 Zyxaphis canae (Williams) [Homoptera: Aphididae]

2023 Zyxaphis filifoliae (Gillette & Palmer) [Homoptera: Aphididae]

2024 Zyxaphis hermistonii (Wilson) [Homoptera: Aphididae]

2025 Zyxaphis minutissima (Gillette & Palmer) [Homoptera: Aphididae]

2026 Pleotrichophorus longinectarius (Gillette & Palmer) [Homoptera: Aphididae]

2027 Macrosiphoniella artemisiae [Homoptera: Aphididae]

2028 Macrosiphoniella ludovicianae (Oestlund) [Homoptera: Aphididae]

2029 Zyxaphis oregonensis (Wilson) [Homoptera: Aphididae]

2030 Hyperomyzus accidentalis (Knowlton) [Homoptera: Aphididae]

2031 Macrosiphoniella frigidicola Gillette & Palmer [Homoptera: Aphididae]

2032 Obtusicauda albicornus (Knowlton & Allen) [Homoptera: Aphididae]

2033 Obtusicauda anomella (Knowlton & Allen) [Homoptera: Aphididae]

2034 Obtusicauda artemisiphila (Knowlton & Allen) [Homoptera: Aphididae]

2035 Obtusicauda cefsmithi (Knowlton & Allen) [Homoptera: Aphididae]

2036 Obtusicauda filifoliae (Gillette & Palmer) [Homoptera: Aphididae]

2037 Obtusicauda flavila (Knowlton & Allen) [Homoptera: Aphididae]

2038 Obtusicauda jonesi (Gillette & Palmer) [Homoptera: Aphididae]

2039 Obtusicauda zerohypsi (Knowlton & Allen) [Homoptera: Aphididae]

2040 Obtusicauda zerotherum (Knowlton & Allen) [Homoptera: Aphididae]

2041 Pleotrichophorus decampus (Knowlton & Smith) [Homoptera: Aphididae]

2042 Pleotrichophorus heterohirsutus (Gillette & Palmer) [Homoptera: Aphididae]

2043 Pleotrichophorus longipes (Gillette & Palmer) [Homoptera: Aphididae]

2044 Pleotrichophorus pullus (Gillette & Palmer) [Homoptera: Aphididae]

2045 Pleotrichophorus quadritrichus pallidus Corpuz & Raros & Cook [Homoptera: Aphididae]

2046 Pleotrichophorus spatulavillus (Knowlton & Smith) [Homoptera: Aphididae]

2047 Pseudoepameibaphis zavillus Knowlton & Smith [Homoptera: Aphididae]

2048 Zyxaphis infrequens (Knowlton) [Homoptera: Aphididae]

2049 Zyxaphis utahensis Knowlton [Homoptera: Aphididae]

2050 Pleotrichophorus brevinectarius (Gillette & Palmer) [Homoptera: Aphididae]

2051 Aphis maidiradicis Forbes (Corn root aphid) [Homoptera: Aphididae]

2052 Macrosiphoniella glabra (Gillette & Palmer) [Homoptera: Aphididae]

2053 Pleotrichophorus filifoliae (Palmer) [Homoptera: Aphididae]

2054 Prociphilus erigeronensis (Thomas) [Homoptera: Aphididae]

2055 Xerophilaphis tetrapteralis (Cockerell) [Homoptera: Aphididae]

2056 Liosomaphis berberidis (Kaltenbach) (Barberry aphid) [Homoptera: Aphididae] Immature/Adult Guild: Sap feeder: leaves/Sap feeder: leaves

2057 Calaphis betulaecolens (Fitch) (Common birch aphid) [Homoptera: Aphididae]

2058 Calaphis coloradensis Granovsky [Homoptera: Aphididae]

2059 Calaphis flava Mordvilko [Homoptera: Aphididae]

2060 Euceraphis gillettei Davidson [Homoptera: Aphididae]

2061 Neosymydobius intermedius [Homoptera: Aphididae]

2062 Euceraphis punctipennis Zetterstedt [Homoptera: Aphididae]

2063 Euceraphis betulae (Koch) (European birch aphid) [Homoptera: Aphididae]

2064 Glyphina betulae (Linnaeus) [Homoptera: Aphididae]

2065 Nearctaphis kachena (Hottes) [Homoptera: Aphididae]

2066 Aphis ornata (Gillette & Palmer) [Homoptera: Aphididae]

2067 Illinoia azaleae (Mason) [Homoptera: Aphididae]

2068 Pleotrichophorus neosporadicus Corpuz & Raros & Cook [Homoptera: Aphididae]

2069 Pleotrichophorus packi brevis Corpuz & Raros & Cook [Homoptera: Aphididae]

2070 Pleotrichophorus palmerae (Knowlton) [Homoptera: Aphididae]

2071 Pleotrichophorus sporadicus (Knowlton) (Sporadic rabbitbrush aphid) [Homoptera: Aphididae]

2072 Pleotrichophorus zerozoous (Knowlton & Smith) [Homoptera: Aphididae]

2073 Uroleucon aaroni (Knowlton) [Homoptera: Aphididae]

2074 Uroleucon ambrosiae (Thomas) (Brown ambrosia aphid) [Homoptera: Aphididae]

2075 Uroleucon escalantii (Knowlton) [Homoptera: Aphididae]

2076 Zyxaphis chrysothamni (Wilson) (Rabbitbrush twig bark aphid) [Homoptera: Aphididae]

2077 Zyxaphis chrysothamnicola (Gillette & Palmer) (Long rostrumed rabbitbrush aphid) [Homoptera: Aphididae]

2078 Zyxaphis crypta (Pack & Knowlton) [Homoptera: Aphididae]

2079 Ballana polica DeLong [Homoptera: Cicadellidae]

2080 Pleotrichophorus magnautensus (Knowlton & Smith) [Homoptera: Aphididae]

2081 Anoecia corni (Fabricius) [Homoptera: Aphididae]

2082 Anoecia cornicola (Walsh) [Homoptera: Aphididae]

2083 Aphis cornifoliae Fitch (Dogwood or sunflower aphid) [Homoptera: Aphididae]

2084 Aphis helianthi Monell (Dogwood or sunflower aphid) [Homoptera: Aphididae]

2085 Aphis neogillettei Palmer [Homoptera: Aphididae]

2086 Aphis nigratibialis Robinson [Homoptera: Aphididae]

2087 Stegophylla querci (Fitch) (White banded dogwood aphid) [Homoptera: Aphididae]

2088 Myzocallis coryli (Goeze) (Filbert aphid) [Homoptera: Aphididae]

2089 Ovatus crataegarius (Walker) [Homoptera: Aphididae]

2090 Aphis pomi DeGeer (Green apple aphid) [Homoptera: Aphididae]

2091 Nearctaphis bakeri (Cowen) (Short-beaked clover aphid) [Homoptera: Aphididae]

2092 Rhopalosiphum insertum (Walker) [Homoptera: Aphididae]

2093 Rhopalosiphum nigrum Richards [Homoptera: Aphididae]

2094 Utamphorophora crataegi (Monell) (Four-spotted hawthorn aphid) [Homoptera: Aphididae]

2095 Capitophorus elaeagni (Del Guercio) [Homoptera: Aphididae]

2096 Capitophorus hippophaes (Walker) [Homoptera: Aphididae]

2097 Braggia agathona (Hottes) [Homoptera: Aphididae]

2098 Braggia echinata Gillette & Palmer [Homoptera: Aphididae]

2099 Braggia uncompahgrensis Hottes [Homoptera: Aphididae]

2100 Aphis erigoni [Homoptera: Aphididae]

2101 Cinara juniperi (DeGeer) [Homoptera: Aphididae]

2102 Cinara sibericae (Gillette & Palmer) (American juniper aphid) [Homoptera: Aphididae]

2103 Cinara burrilli (Wilson) [Homoptera: Aphididae]

2104 Amphicercidus flocculosus (Gillette & Palmer) [Homoptera: Aphididae]

2105 Hyadaphis foeniculi (Passerini) (Honeysuckle and parsnip aphid) [Homoptera: Aphididae]

2106 Rhopalomyzus lonicerae (Siebold) [Homoptera: Aphididae]

2107 Illinoia crystleae (Smith & Knowlton) [Homoptera: Aphididae]

2108 Aphis lupini Gillette & Palmer (Western lupine aphid) [Homoptera: Aphididae]

2109 Macrosiphum albifrons Essig (Essig's lupine aphid) [Homoptera: Aphididae]

2110 Macrosiphum timpanogos Knowlton [Homoptera: Aphididae]

2111 Macrosiphum zionense Knowlton [Homoptera: Aphididae]

2112 Aphis craccivora Koch (Cowpea aphid) [Homoptera: Aphididae] Immature/Adult Guild: Leaf,stem feeder/Leaf,stem feeder

2113 Aphis citricola Van der Goot (Spiraea aphid) [Homoptera: Aphididae]

2114 Asiphonaphis pruni Wilson & Davis [Homoptera: Aphididae]

2115 Brachycaudus persicae (Passerini) (Black peach aphid) [Homoptera: Aphididae]

2116 Rhopalosiphum cerasifoliae (Fitch) (Chokecherry aphid) [Homoptera: Aphididae]

2117 Roepkea bakeri [Homoptera: Aphididae]

2118 Hyalopterus pruni (Geoffroy) (Mealy plum aphid) [Homoptera: Aphididae]

2119 Rhopalosiphum musae (Schouteden) [Homoptera: Aphididae]

2120 Rhopalosiphum nymphaeae (Linnaeus) (Waterlily aphid) [Homoptera: Aphididae]

2121 Rhopalosiphum padi (Linnaeus) [Homoptera: Aphididae]

2122 Hoplochaitophorus quercicola (Monell) (Honeysuckle and parsnip aphid) [Homoptera: Aphididae]

2123 Myzocallis discolor (Monell) (Eastern dusky-winged oak aphid) [Homoptera: Aphididae]

2124 Myzocallis punctatus (Monell) (Western dusky-winged oak aphid) [Homoptera: Aphididae]

2125 Neosymydobius albasiphus (Davis) [Homoptera: Aphididae]

2126 Stegophylla quercifoliae (Gillette) (Woolly oak aphid) [Homoptera: Aphididae]

2127 Thelaxes californica (Davidson) (Oak bud aphid) [Homoptera: Aphididae]

2128 Tuberculatus californicus (Baker) [Homoptera: Aphididae]

2129 Tuberculatus maureri (Swain) [Homoptera: Aphididae]

2130 Aphis ribiensis Gillette & Palmer [Homoptera: Aphididae]

2131 Aphis ribigillettei Knowlton & Allen [Homoptera: Aphididae]

2132 Hyperomyzus lactucae (Linnaeus) [Homoptera: Aphididae]

2133 Hyperomyzus nigricornis (Knowlton) [Homoptera: Aphididae]

2134 Hyperomyzus ribiellus (Davis) (Ornamental currant aphid) [Homoptera: Aphididae]

2135 Kakimia cynosbati (Oestlund) [Homoptera: Aphididae]

2136 Kakimia houghtonensis russellae Heie. [Homoptera: Aphididae]

2137 Kakimia houghtonensis occidentalis Heie. [Homoptera: Aphididae]

2138 Kakimia ribeutahensis Knowlton [Homoptera: Aphididae]

2139 Aphis neomexicana pacifica Davidson [Homoptera: Aphididae]

2140 Capitophorus corambus Hottes & Frison [Homoptera: Aphididae]

2141 Acyrthosiphon dirhodum (Walker) (Rose grass aphid) [Homoptera: Aphididae]

2142 Acyrthosiphon pentatrichopus Hille Ris Lambers [Homoptera: Aphididae]

2143 Chaetosiphon fragaefolii (Cockerell) (Strawberry aphid) [Homoptera: Aphididae]

2144 Chaetosiphon minor (Forbes) [Homoptera: Aphididae]

2145 Chaetosiphon potentillae (Walker) [Homoptera: Aphididae]

2146 Chaetosiphon tetrarhodum (Walker) [Homoptera: Aphididae]

2147 Chaetosiphon thomasi Hille Ris Lambers [Homoptera: Aphididae]

2148 Eomacrosiphum nigromaculosum (MacDougall) (Black and red rose aphid) [Homoptera: Aphididae]

2149 Maculolachnus submacula (Walker) (Hairy rose aphid) [Homoptera: Aphididae]

2150 Rhodobium porosum (Sanderson) [Homoptera: Aphididae]

2151 Whalgreniella nervata (Gillette) (Rose and bearberry aphid) [Homoptera: Aphididae]

2152 Acyrthosiphon titigula (Hottes) [Homoptera: Aphididae]

2153 Chaetosiphon hottesi Stroyan [Homoptera: Aphididae]

2154 Dysaphis plataginea (Passerini) (Rosy apple aphid) [Homoptera: Aphididae]

2155 Amphorophora agathonica Hottes [Homoptera: Aphididae]

2156 Amphorophora bonnevilla Knowlton & Allen [Homoptera: Aphididae]

2157 Amphorophora rubi (Kaltenbach) (European raspberry aphid) [Homoptera: Aphididae] Immature/Adult Guild: Sap feeder: shoots/Sap feeder: shoots

2158 Amphorophora sensoriata Mason [Homoptera: Aphididae]

2159 Amphorophora tigwatensa Hottes [Homoptera: Aphididae]

2160 Macrosiphum californicum (Clarke) (California willow aphid) [Homoptera: Aphididae]

2161 Aphis farinosa Gmelin [Homoptera: Aphididae]

2162 Aphis salicariae Koch [Homoptera: Aphididae]

2163 Brevicoryne fraterna (Strom.) [Homoptera: Aphididae]

2164 Cavariella aegopodii (Scopoli) [Homoptera: Aphididae]

2165 Cavariella digitata Hille Ris Lambers [Homoptera: Aphididae]

2166 Cavariella knowltoni Hille Ris Lambers [Homoptera: Aphididae]

2167 Cavariella pastinacae (Linnaeus) [Homoptera: Aphididae]

2168 Cavariella theobaldi (Gillette & Bragg) [Homoptera: Aphididae]

2169 Chaitophorus abditus (Hottes) [Homoptera: Aphididae]

2170 Chaitophorus eoessigi Hille Ris Lambers [Homoptera: Aphididae]

2171 Chaitophorus intermedius Hille Ris Lambers [Homoptera: Aphididae]

2172 Chaitophorus knowltoni Hille Ris Lambers [Homoptera: Aphididae]

2173 Chaitophorus monelli (Essig) [Homoptera: Aphididae]

2174 Chaitophorus salicicorticis (Essig) [Homoptera: Aphididae]

2175 Chaitophorus saliciniger (Knowlton) [Homoptera: Aphididae]

2176 Fullawaya saliciradicis Essig [Homoptera: Aphididae] Immature/Adult Guild: Root feeder/Root feeder

2177 Fullawaya terricola (Hottes & Frison) [Homoptera: Aphididae]

2178 Myzus ornatus Laing [Homoptera: Aphididae]

2179 Pterocomma pilosum Buckton [Homoptera: Aphididae]

2180 Aphis fabae Scopoli (Bean aphid) [Homoptera: Aphididae]

2181 Macrosiphum stanleyi Wilson [Homoptera: Aphididae]

2182 Aphis sambuci Linnaeus (Elder aphid) [Homoptera: Aphididae]

2183 Capitophorus shepherdiae Gillette & Bragg [Homoptera: Aphididae]

2184 Myzus ascalonicus Doncaster (Shallot aphid) [Homoptera: Aphididae]

2185 Aphthargelia symphoricarpi (Thomas) (Snowberry aphid) [Homoptera: Aphididae]

2186 Cedoaphis incognita Hottes & Friston [Homoptera: Aphididae]

2187 Pleotrichophorus tetradymiae Smith [Homoptera: Aphididae] Immature/Adult Guild: Sap feeder/Sap feeder

2188 Ceruraphis viburnicola (Gillette) (Snowball aphid) [Homoptera: Aphididae]

2189 Aphis gutierreziae (Pack & Knowlton) [Homoptera: Aphididae]

2190 Uroleucon zeroguiterreziae (Smith & Knowlton) [Homoptera: Aphididae]

2191 Drosophila pachea Patterson & Wheeler [Diptera: Drosophilidae]

2192 Drosophila nigrospiracula Patterson & Wheeler [Diptera: Drosophilidae]

2193 Drosophila mojavensis Patterson & Crow [Diptera: Drosophilidae]

2194 Drosophila arizonensis [Diptera: Drosophilidae]

2195 Drosophila longicornis [Diptera: Drosophilidae]

2196 Drosophila aldrichi [Diptera: Drosophilidae]

2197 Drosophila mulleri [Diptera: Drosophilidae]

2198 Ctenolepisma longicaudata [Thysanura: Lepismatidae]

2199 Arenivaga spp. (Sand roaches) [Orthoptera: Polyphagidae]

2200 Chyphotes petiolatus [Hymenoptera: Mutillidae]

2201 Photopsis spp. [Hymenoptera: Scoliidae]

2202 Euryoros furtivus [Hymenoptera: Family?]

2203 Stilbopogon spp. [Hymenoptera: Family?]

2204 Pogonomyrmex barbatus (F. Smith) (Texas harvester ant) [Hymenoptera: Formicidae]

2205 Forelius spp. [Hymenoptera: Formicidae]

2206 Veromessor pergandei (Mayr) (Harvester ant) [Hymenoptera: Formicidae]

2207 Harpalus spp. [Coleoptera: Carabidae]

2208 Stenolophus spp. [Coleoptera: Carabidae]

2209 Araeoschizus spp. [Coleoptera: Tenebrionidae]

2210 Triorophus laevis [Coleoptera: Tenebrionidae]

2211 Cryptoglossa verrucosa LeConte [Coleoptera: Tenebrionidae]

2212 Centrioptera muricata LeConte [Coleoptera: Tenebrionidae]

2213 Centrioptera variolosa [Coleoptera: Tenebrionidae]

2214 Argoporis bicolor [Coleoptera: Tenebrionidae]

2215 Eleodes armata LeConte (Armored stink beetle) [Coleoptera: Tenebrionidae]

2216 Nocibiotes granulatus [Coleoptera: Tenebrionidae]

2217 Nocibiotes rubripes [Coleoptera: Tenebrionidae]

2218 Drosophila victoria [Diptera: Drosophilidae]

2219 Pogonomyrmex californicus estebanius Pergande [Hymenoptera: Formicidae]

2220 Papilio indra fordi Comstock & Martin [Lepidoptera: Papilionidae]

2221 Papilio rudkini Comstock [Lepidoptera: Papilionidae]

2222 Gerstaeckeria turbida [Coleoptera: Curculionidae]

2223 Feltia subterranea (Granulate cutworm) [Lepidoptera: Noctuidae]

2224 Loxostege sticticalis (Linnaeus) (Beet webworm) [Lepidoptera: Pyralidae]

2225 Calligrapha spp. [Coleoptera: Chrysomelidae]

2226 Chalcoides spp. [Coleoptera: Chrysomelidae]

2227 Trirhabda canadensis (Kirby) (Goldenrod beetle) [Coleoptera: Chrysomelidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

2228 Capitophorus magnatensis Knowlton & Smith [Homoptera: Aphididae]

2229 Gnathium spp. [Coleoptera: Meloidae]

2230 Malachius aeneus Fabricius [Coleoptera: Melyridae]

2231 Coleophora spp. [Lepidoptera: Coleophoridae] Immature/Adult Guild: Leaf feeder/?

2232 Crambus spp. [Lepidoptera: Pyralidae]

2233 Aroga spp. [Lepidoptera: Gelechiidae]

2234 Cameraria spp. [Lepidoptera: Gracilariidae]

2235 Nymphalis antiopa (Linnaeus) (Morning-cloak butterfly) [Lepidoptera: Nymphalidae] Immature/Adult Guild: Skeletonizer/?

2236 Schinia spp. [Lepidoptera: Noctuidae]

2237 Oidaematophorus grisescens Walsingham [Lepidoptera: Pterophoridae]

2238 Sarcophaga planifrons [Diptera: Sarcophagidae]

2239 Oecanthus nigricornis argentinus Saussure [Orthoptera: Gryllidae]

2240 Capitophorus gregarius Knowlton [Homoptera: Aphididae]

2241 Myzocallis maureni Swain [Homoptera: Aphididae]

2242 Aphis rubifolii Thomas [Homoptera: Aphididae]

2243 Calaphis annulata (Koch.) [Homoptera: Aphididae]

2244 Ceruraphis eriophori (Walker) [Homoptera: Aphididae]

2245 Myzocallis alhambra Davidson [Homoptera: Aphididae]

2246 Thargelia symphoricarpi (Thomas) [Homoptera: Aphididae]

2247 Empoasca neaspersa Oman & Wheeler [Homoptera: Cicadellidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

2248 Fieberiella florii (Stal) [Homoptera: Cicadellidae] Immature/Adult

Guild: Plant disease vector/Plant disease vector

2249 Scolops uhleri Ball [Homoptera: Dictyopharidae]

2250 Telamonthe pulchella (Ball) [Homoptera: Membracidae]

2251 Pulvinaria bigeloviae Cockerell [Homoptera: Coccidae]

2252 Acmaeodera sparsa Horn [Coleoptera: Buprestidae] Oviposition Medium: Bark surfaces

2253 Chaleoides spp. [Coleoptera: Chrysomelidae]

2254 Trichodes simulator Horn [Coleoptera: Chrysomelidae]

2255 Coccinella nivicola monticola Casey [Coleoptera: Coccinellidae]

2256 Hyperaspis lateralis wellmani Nun. [Coleoptera: Coccinellidae]

2257 Cleonus vittatus Kirby [Coleoptera: Curculionidae]

2258 Eumecomera obscura (LeConte) [Coleoptera: Oedemeridae]

2259 Callitroga macellaria (F.) [Diptera: Calliphoridae]

2260 Eucalliphora lilaea (Walker) [Diptera: Calliphoridae]

2261 Paradejeania rutilioides (Jean.) [Diptera: Tachinidae]

2262 Trichodejeania vexatrix (Osten Sacken) [Diptera: Tachinidae]

2263 Sarcophaga hunteri Hough [Diptera: Sarcophagidae]

2264 Sarcophaga lherminiera R.D. [Diptera: Sarcophagidae]

2265 Sarcophaga rapax Walker [Diptera: Sarcophagidae]

2266 Senotainia trilineata wdW. [Diptera: Sarcophagidae]

2267 Mesograpta marginata (Say) [Diptera: Syrphidae]

2268 Tubifera tenax (Linnaeus) [Diptera: Syrphidae]

2269 Archytas apicifer Walker [Diptera: Tachinidae]

2270 Chaetophlepsis tarsalis Tns. [Diptera: Tachinidae]

2271 Exoristoides johnsoni Coq. [Diptera: Tachinidae]

2272 Fabriciella egula Rnh. [Diptera: Tachinidae]

2273 Fabriciella latigena Tll. [Diptera: Tachinidae]

2274 Leucostoma acirostre Rnh. [Diptera: Tachinidae]

2275 Lydina areos Walker [Diptera: Tachinidae]

2276 Peleteria campestris Cn. [Diptera: Tachinidae]

2277 Cucullia spp. [Lepidoptera: Noctuidae]

2278 Apterona crenulella (Bruand) (Snailcase bagworm) [Lepidoptera: Psychidae] Immature/Adult Guild: Leaf feeder/?

2279 Loxostege spp. [Lepidoptera: Pyralidae]

2280 Scythris spp. [Lepidoptera: Scythridae] Immature/Adult Guild: Leaf feeder/?

2281 Formica microgyna [Hymenoptera: Formicidae]

2282 Amauronematus spp. [Hymenoptera: Tenthredinidae]

2283 Climaciella brunnea occidentis Banks (Western mantispid) [Neuroptera: Mantispidae]

2284 Oecanthus californicus Saussure (California tree cricket) [Orthoptera: Gryllidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

2285 Oecanthus niveus (DeGeer) (Snowy tree cricket) [Orthoptera: Gryllidae]

2286 Macrosiphoniella sanborni (Gillette) (Chrysanthemum aphid) [Homoptera: Aphididae]

2287 Adalia binotata quadramaculata (Scop.) [Coleoptera: Coccinellidae]

2288 Eupagoderes spp. [Coleoptera: Curculionidae]

2289 Acyrthosiphon caraganae Chol. [Homoptera: Aphididae]

2290 Anoecia querci (Fitch) [Homoptera: Aphididae]

2291 Aphis bonnevillensis Knowlton [Homoptera: Aphididae]

2292 Aphis crypta Pack & Knowlton [Homoptera: Aphididae]

2293 Aphis filifoliae Gillette & Palmer [Homoptera: Aphididae]

2294 Aphis hermistonii Wilson [Homoptera: Aphididae]

2295 Brachyunguis gregalis [Homoptera: Aphididae]

2296 Aulacorthum solani (Kalt.) [Homoptera: Aphididae]

2297 Capitophorus xerozoous Knowlton & Smith [Homoptera: Aphididae]

2298 Epacmus spp. [Diplura: Bombyliidae]

2299 Craspedolepta minutissima (Gillette & Palmer) [Homoptera: Aphididae]

2300 Dactynotus ambrosiae (=Macrosiphum ambrosiae) (Thomas) [Homoptera: Aphididae]

2301 Drepanaphis spicata Smith [Homoptera: Aphididae]

2302 Masonaphis azaleae (Mason) [Homoptera: Aphididae]

2303 Masonaphis masoni (Knowlton) [Homoptera: Aphididae]

2304 Myzocallis bellus (Walsh) [Homoptera: Aphididae]

2305 Myzus calangei Essig [Homoptera: Aphididae]

2306 Oestlundia maxima Mason [Homoptera: Aphididae]

2307 Pentatrichopus thomasi (H.R.L.) [Homoptera: Aphididae]

2308 Pleotrichophorus utensus (Pack & Knowlton) [Homoptera: Aphididae]

2309 Pterocomma beulahensis (Cockerell) [Homoptera: Aphididae]

2310 Aspidiotus perniciosus Comstock (San Jose scale) [Homoptera: Diaspididae] Immature/Adult Guild: Sap feeder/Sap feeder

2311 Orthezia sarcobati Morrison [Homoptera: Ortheziidae]

2312 Myrmex lineata knowltoni Sleeper [Coleoptera: Curculionidae]

2313 Carpophilus pallipennis (Say) [Coleoptera: Nitidulidae] Immature/Adult Guild: ?/Bud,flower feeder

2314 Meligethes dauricus Mots. [Coleoptera: Nitidulidae]

2315 Brachypterolus pulicarius (Linnaeus) [Coleoptera: Nitidulidae]

2316 Hyperaspis tetranensa Casey [Coleoptera: Coccinellidae]

2317 Hyperaspis fastidiosus Casey [Coleoptera: Coccinellidae]

2318 Scymnus uteanus Casey [Coleoptera: Coccinellidae]

2319 Olibrus rufipes LeConte [Coleoptera: Phalacridae]

2320 Monorchus bimaculatus [Coleoptera: Cerambycidae]

2321 Crossidius corallinus [Coleoptera: Cerambycidae]

2322 Crossidius allgewahri LeConte [Coleoptera: Cerambycidae]

2323 Centrodera nevadica LeConte [Coleoptera: Cerambycidae]

2324 Centrodera barri [Coleoptera: Cerambycidae]

2325 Technophilus croceicollis Menc. [Coleoptera: Carabidae]

2326 Lebia spp. [Coleoptera: Carabidae]

2327 Harpalus basilaris Kirby [Coleoptera: Carabidae]

2328 Harpalus fraternus [Coleoptera: Carabidae]

2329 Deronectes striatellus LeConte [Coleoptera: Dytiscidae]

2330 Aleocharinae spp. [Coleoptera: Staphylinidae]

2331 Agrilus malrostri [Coleoptera: Buprestidae] Oviposition Medium: Bark surfaces

2332 Acmaeodera variegata LeConte [Coleoptera: Buprestidae] Oviposition Medium: Bark surfaces

2333 Chrysobothris spp. [Coleoptera: Buprestidae] Oviposition Medium: Bark surfaces

2334 Pyropyga spp. [Coleoptera: Lampyridae]

2335 Cryptorhopalum uteanum Casey [Coleoptera: Dermestidae]

2336 Hydnocera spp. [Coleoptera: Cleridae]

2337 Collops spp. [Coleoptera: Melyridae]

2338 Collops bipunctatus Say (Two-spotted collops) [Coleoptera: Melyridae] Immature/Adult Guild: Predator/Predator

2339 Tanaops spp. [Coleoptera: Malachiidae]

2340 Anthocomus spp. [Coleoptera: Malachiidae]

2341 Anthocomus thevenetii [Coleoptera: Malachiidae]

2342 Attalus spp. [Coleoptera: Malachiidae]

2343 Malachiidae spp. [Coleoptera: Malachiidae]

2344 Dasytes cruralis LeConte [Coleoptera: Dasytidae]

2345 Mecomycter spp. [Coleoptera: Dasytidae]

2346 Amecocerus luteipes (LeConte) [Coleoptera: Dasytidae]

2347 Lytta mejister [Coleoptera: Meloidae]

2348 Gnathius spp. [Coleoptera: Meloidae]

2349 Cryptocephalus confluentus Say [Coleoptera: Chrysomelidae]

2350 Pachybrachis bivittatus (Say) [Coleoptera: Chrysomelidae]

2351 Pachybrachis croftus Bowditch [Coleoptera: Chrysomelidae]

2352 Hispinae spp. [Coleoptera: Chrysomelidae]

2353 Chrysomelinae spp. [Coleoptera: Chrysomelidae]

2354 Calomicrus spp. [Coleoptera: Chrysomelidae]

2355 Crepidodera nana Say [Coleoptera: Chrysomelidae]

2356 Chaetocnema nr. brunnescens Horn [Coleoptera: Chrysomelidae]

2357 Disonycha latiovittata Hatch (Five-striped flea beetle) [Coleoptera: Chrysomelidae] Immature/Adult Guild: Skeletonizer/Leaf feeder

2358 Disonycha latifrons Schaeffer [Coleoptera: Chrysomelidae] Immature/Adult Guild: Skeletonizer/Leaf feeder

2359 Saxinis saucia LeConte (Red-shouldered leaf beetle) [Coleoptera: Chrysomelidae] Immature/Adult Guild: ?/Leaf feeder

2360 Paria quadriguttata (LeConte) [Coleoptera: Chrysomelidae]

2361 Longitarsus spp. [Coleoptera: Chrysomelidae]

2362 Monoxia grisea Blake [Coleoptera: Chrysomelidae]

2363 Monoxia obesula Blake [Coleoptera: Chrysomelidae]

2364 Monoxia angularis (LeConte) [Coleoptera: Chrysomelidae]

2365 Allopoda spp. [Coleoptera: Chrysomelidae]

2366 Anthonomus spp. [Coleoptera: Curculionidae] Immature/Adult Guild: ?/Flower,leaf feeder

2367 Cercopedius artemisiae (Pierce) [Coleoptera: Curculionidae]

2368 Dorytomus squamosus LeConte [Coleoptera: Curculionidae]

2369 Ophryastes sulcirostris (Say) [Coleoptera: Curculionidae]

2370 Leptoconops torrens (Townsend) (No-see-um or bloodsucking gnat) [Diptera: Ceratopogonidae] Immature/Adult Guild: ?/Blood feeder

2371 Bibio albipennis (Say) (White-winged March fly) [Diptera: Bibionidae]

2372 Syritta pipiens (Linnaeus) [Diptera: Syrphidae]

2373 Cryptochironomus spp. [Diptera: Chironomidae]

2374 Cricotopus spp. [Diptera: Chironomidae]

2375 Forcipomyia brevipennis (Macq.) [Diptera: Ceratopogonidae]

2376 Forcipomyia squamipes (Coq.) [Diptera: Ceratopogonidae]

2377 Leptoconops bertessi [Diptera: Ceratopogonidae]

2378 Culicoides spp. (Punkies) [Diptera: Ceratopogonidae]

2379 Dasyhelea mutabilis Coquillett [Diptera: Ceratopogonidae]

2380 Aedes vexan (Adm.) (Vexatious mosquito) [Diptera: Culicidae]

2381 Aedes spp. [Diptera: Culicidae]

2382 Docosia spp. [Diptera: Mycetophilidae]

2383 Neolasioptera spp. [Diptera: Cecidomyiidae]

2384 Ledomyia spp. [Diptera: Cecidomyiidae]

2385 Erioptera cana (Walker) [Diptera: Tipulidae]

2386 Simulium griseum Coq. [Diptera: Simuliidae]

2387 Scenopinidae spp. (Window flies) [Diptera: Scenopinidae]

2388 Allograpta obliqua Say [Diptera: Syrphidae] Immature/Adult Guild: Predator/Nectar feeder

2389 Baccha lemur Osten Sacken (Lemur syrphid) [Diptera: Syrphidae]

2390 Paragus tibialis Fallen [Diptera: Syrphidae]

2391 Volucella candata Cwr. [Diptera: Syrphidae]

2392 Xylota flavitibia Big. [Diptera: Syrphidae]

2393 Halophilus latifrons Loew [Diptera: Syrphidae]

2394 Nemotelus politus Hanson [Diptera: Stratiomyidae]

2395 Sargus cuprarius (Linnaeus) [Diptera: Stratiomyidae]

2396 Silvius quadrivitattus Say [Diptera: Tabanidae]

2397 Physocephala texana (Williston) [Diptera: Conopidae]

2398 Robertsonomyia parva V.D. [Diptera: Conopidae]

2399 Thecophora propinqua (Adams) [Diptera: Conopidae]

2400 Thecophora nigripes Com. [Diptera: Conopidae]

2401 Zodion americanum [Diptera: Conopidae]

2402 Zodion fulvifrons Say [Diptera: Conopidae]

2403 Zodion cinereiventri V.D. [Diptera: Conopidae]

2404 Pipunculus subopacus Loew [Diptera: Pipunculidae]

2405 Prothecus spp. [Diptera: Pipunculidae]

2406 Pipunculus spp. [Diptera: Pipunculidae]

2407 Mydas xanthopterus [Diptera: Asilidae]

2408 Efferia spp. [Diptera: Asilidae]

2409 Holopogon atrifrons Cole [Diptera: Asilidae]

2410 Mallophorina guildiana Will. [Diptera: Asilidae]

2411 Ospriocerus vallensis Martin [Diptera: Asilidae]

2412 Promachus aldrichii Hine [Diptera: Asilidae]

2413 Stichopogon trifasciatus Say [Diptera: Asilidae]

2414 Wilcoxia painteri Wilcox [Diptera: Asilidae]

2415 Hemerodromia spp. [Diptera: Empididae]

2416 Hilara spp. [Diptera: Empididae]

2417 Platypalpus spp. [Diptera: Empididae]

2418 Dipalta serpentina Osten Sacken [Diptera: Bombyliidae]

2419 Exoprosopa doris Osten Sacken [Diptera: Bombyliidae]

2420 Exoprosopa calyptera Say [Diptera: Bombyliidae]

2421 Mythicomyia atra Cresson [Diptera: Bombyliidae]

2422 Toxophora virgata Osten Sacken [Diptera: Bombyliidae]

2423 Systoechus vulgaris Loew [Diptera: Bombyliidae]

2424 Villa lepidota (Osten Sacken) [Diptera: Bombyliidae]

2425 Villa syrtis Coq. [Diptera: Bombyliidae]

2426 Psilocephala costalis Loew [Diptera: Therevidae]

2427 Megaselia spp. [Diptera: Phoridae]

2428 Aphanotrigonum spp. [Diptera: Chloropidae]

2429 Lasiosina similis (Mall.) [Diptera: Chloropidae]

2430 Meromyza nigriventris (Macq.) [Diptera: Chloropidae]

2431 Olcella parva (Ad.) [Diptera: Chloropidae]

2432 Olcella projecta (Mall.) [Diptera: Chloropidae]

2433 Olcella provocans (Becker) [Diptera: Chloropidae]

2434 Olcella punctifrons (Becker) [Diptera: Chloropidae]

2435 Siphonella neglecta (Mall.) [Diptera: Chloropidae]

2436 Chamaemyia juncorum Fallen [Diptera: Chamaemyiidae]

2437 Desmometopa tarsalis Loew [Diptera: Milichiidae]

2438 Leptometopa latipes Meigen [Diptera: Milichiidae]

2439 Meoneura nr. wirthi Collen [Diptera: Milichiidae]

2440 Milichia nr. aethiops Mall. [Diptera: Milichiidae]

2441 Milichia spp. [Diptera: Milichiidae]

2442 Allotrichoma spp. [Diptera: Ephydridae]

2443 Atissa pygmaea Halid. [Diptera: Ephydridae]

2444 Ephydra cinerea Jones [Diptera: Ephydridae]

2445 Hydrellia spp. [Diptera: Ephydridae]

2446 Lamprosatella sibilans Halid. [Diptera: Ephydridae]

2447 Mosillus tibialis Cresson [Diptera: Ephydridae]

2448 Psilopa olga Cresson [Diptera: Ephydridae]

2449 Scatella paludum (Meigen) [Diptera: Ephydridae]

2450 Tethinidae spp. [Diptera: Tethinidae]

2451 Pelomyiella melanderi (Start.) [Diptera: Tethinidae]

2452 Myrmex lineolata [Coleoptera: Curculionidae]

2453 Cremastus spp. [Hymenoptera: Ichneumonidae]

2454 Irbisia brachycera [Hemiptera: Miridae]

2455 Conostethes americanus [Hemiptera: Miridae]

2456 Scaptomyza pallida Zetterstedt [Diptera: Drosophilidae]

2457 Malacosoma fragile Stretch (Great Basin tent caterpillar) [Lepidoptera: Lasiocampidae] Immature/Adult Guild: Leaf feeder/? Overwintering Stage: Eggs Oviposition Medium: Twig surfaces

2458 Hyalophora spp. [Lepidoptera: Saturniidae]

2459 Malacosoma californicum lutescens (Newmoegen & Dyar) [Lepidoptera: Lasiocampidae] Immature/Adult Guild: Leaf feeder/?

2460 Malacosoma californicum pluviale (Dyar) [Lepidoptera: Lasiocampidae] Immature/Adult Guild: Leaf feeder/?

2461 Trishoromyia canadensis Felt (Gall midge) [Diptera: Cecidomyiidae]

2462 Hoplocampa spp. (Sawfly) [Hymenoptera: Tenthredinidae]

2463 Lepidosaphes ulmi (Linnaeus) (Oystershell scale) [Homoptera: Diaspididae] Immature/Adult Guild: Sap feeder/Sap feeder

2464 Eurytoma squamosa Bugbee [Hymenoptera: Eurytomidae] Immature/Adult Guild: Internal seed feeder/?

2465 Lecanium spp. [Homoptera: Coccidae]

2466 Lecanium cerasifex Fitch (Bitterbrush tortoise scale) [Homoptera: Coccidae] Immature/Adult Guild: Sap feeder/Sap feeder

2467 Hemileuca spp. (Buck moths and day moths) [Lepidoptera: Saturniidae] Immature/Adult Guild: Leaf feeder/?

2468 Pseudohazis spp. (Buck moth) [Lepidoptera: Saturniidae]

2469 Altica ambiens (LeConte) [Coleoptera: Chrysomelidae] Immature/Adult Guild: Skeletonizer/Leaf perforator

2470 Pelomyia coronata Loew [Diptera: Tethinidae]

2471 Homoneura spp. [Diptera: Lauxaniidae]

2472 Minettia spp. [Diptera: Lauxaniidae]

2473 Astiosoma nr. aridum Sapr. [Diptera: Asteidae]

2474 Phlebosotera setipalpis Sabr. [Diptera: Asteidae]

2475 Trixoscelis frontalis Fallen [Diptera: Trixoscelididae]

2476 Hemeromyia washingtona Mel. [Diptera: Carnidae]

2477 Meoneura polita Sabr. [Diptera: Carnidae]

2478 Meoneura nr. nigrifrons Mall. [Diptera: Carnidae]

2479 Aciurina lutea Coq. (Gall forming fruit flies) [Diptera: Tephritidae] Immature/Adult Guild: Gall former/Gall former

2480 Aciurina trixa Curran (Gall forming fruit flies) [Diptera: Tephritidae] Immature/Adult Guild: Gall former/Gall former

2481 Eutreta oregona Curr. (Gall forming fruit flies) [Diptera: Tephritidae] Immature/Adult Guild: Gall former/Gall former

2482 Oxyna aterrima Doane [Diptera: Tephritidae]

2483 Paroxyna clathrata Loew [Diptera: Tephritidae]

2484 Trupanea nigricornis (Coquillett) [Diptera: Tephritidae]

2485 Mozena obtusa Uhler [Hemiptera: Coreidae]

2486 Oncideres putator Thomson [Coleoptera: Cerambycidae]

2487 Agrilus palmicollis Horn [Coleoptera: Buprestidae] Oviposition Medium: Bark surfaces

2488 Chauliognathus basilis LeConte [Coleoptera: Cantharidae]

2489 Batyle ignicollis (Say) [Coleoptera: Cerambycidae]

2490 Stenaspis solitaria (Say) [Coleoptera: Cerambycidae]

2491 Babia spp. [Coleoptera: Chrysomelidae]

2492 Chrysolina spp. [Coleoptera: Chrysomelidae]

2493 Coscinoptera spp. [Coleoptera: Chrysomelidae]

2494 Scymnus loewi Mulsant [Coleoptera: Coccinellidae]

2495 Colecerus marmoratus (Say) [Coleoptera: Curculionidae]

2496 Epicauta nigritarsis (LeConte) [Coleoptera: Meloidae]

2497 Phaenicia sericata (Meigen) [Diptera: Calliphoridae]

2498 Orthellia caesarion (Meigen) [Diptera: Muscidae]

2499 Euclytia flava (Townsend) [Diptera: Tachinidae]

2500 Nemorilla pyste (Walker) [Diptera: Tachinidae]

2501 Neacoryphus bicrucis (Say) [Hemiptera: Lygaeidae]

2502 Oncopeltus fasciatus (Dallas) (Spotted milkweed bug) [Hemiptera: Lygaeidae]

2503 Podisus acutissimus (Stallings) [Hemiptera: Pentatomidae]

2504 Gypona paupercula Spangberg [Homoptera: Cicadellidae]

2505 Thyanta accerra McAtee [Hemiptera: Pentatomidae]

2506 Norvellina texana (Ball) [Homoptera: Cicadellidae]

2507 Pacarina puella Davis [Homoptera: Cicadidae]

2508 Ormenis saucia (Van Duzee) [Homoptera: Flatidae] Immature/Adult Guild: Stem feeder/Stem feeder

2509 Tylocentrus recticulatus (Van Duzee) [Homoptera: Membracidae]

2510 Vanduza spp. [Homoptera: Membracidae]

2511 Niesthrea sidae (Fabricius) [Hemiptera: Rhopalidae]

2512 Melissodes nr. ochraea La Berge [Hymenoptera: Apidae]

2513 Iphiaulax spp. [Hymenoptera: Braconidae] Immature/Adult Guild: Ectoparasite/?

2514 Colletes hyalinus Provancher [Hymenoptera: Colletidae]

2515 Euodynerus annulatus (Say) [Hymenoptera: Eumenidae]

2516 Polistes apachus Saussure [Hymenoptera: Vespidae]

2517 Compsus auricephalus (Say) [Coleoptera: Curculionidae]

2518 Enoclerus spp. [Coleoptera: Cleridae]

2519 Spilococcus viridula (Cockerell) [Homoptera: Pseudococcidae]

2520 Phenacoccus spp. [Homoptera: Pseudococcidae]

2521 Acmaeodera spp. (Spotted flower buprestids) [Coleoptera: Buprestidae] Immature/Adult Guild: Wood borer/Flower,leaf feeder Oviposition Medium: Bark surfaces

2522 Melitara dentata Grote (Blue cactus borer) [Lepidoptera: Pyralidae] Immature/Adult Guild: Stem borer/?

2523 Eumysia idahoensis Mackie [Lepidoptera: Pyralidae]

2524 Phigalia plumogeraria (Hulst) (Walnut spanworm) [Lepidoptera: Geometridae] Immature/Adult Guild: Leaf feeder/?

2525 Circotettix rabula Rehn & Hebard [Orthoptera: Acrididae]

2526 Achorutes maturus Folsom [Collembola: Poduridae]

2527 Achorutes armatus (Nicolet) (Armed springtail) [Collembola: Poduridae] Immature/Adult Guild: Saprophage/Saprophage

2528 Neanura persimilis Mills [Collembola: Poduridae]

2529 Microsynamma bohemani (Fallen) [Hemiptera: Miridae]

2530 Deraeocoris nigrifrons Knight [Hemiptera: Miridae]

2531 Halticus intermedius Uhler [Hemiptera: Miridae]

2532 Lopidea ute Knight [Hemiptera: Miridae]

2533 Lygus distinguendus Knight [Hemiptera: Miridae]

2534 Phytocoris interspersus Uhler [Hemiptera: Miridae]

2535 Phytocoris laevis (Uhler) [Hemiptera: Miridae]

2536 Psallus fuscopunctatus [Hemiptera: Miridae]

2537 Psallus cercocarpicola [Hemiptera: Miridae]

2538 Psallus vaccinicola [Hemiptera: Miridae]

2539 Capitophorus rusticatus Knowlton & Smith [Homoptera: Aphididae]

2540 Capitophorus feragaeus Knowlton & Smith [Homoptera: Aphididae]

2541 Capitophorus glandulosus (Kaltenbach) [Homoptera: Aphididae]

2542 Capitophorus magnautensus Knowlton & Smith [Homoptera: Aphididae]

2543 Capitophorus utahensis Pack & Knowlton [Homoptera: Aphididae]

2544 Psiloptera webbi LeConte [Coleoptera: Buprestidae] Oviposition Medium: Bark surfaces

2545 Chrysobothris debilis LeConte [Coleoptera: Buprestidae] Immature/Adult Guild: Wood borer/? Oviposition Medium: Bark surfaces

2546 Chrysobothris axillaris Horn [Coleoptera: Buprestidae] Immature/Adult Guild: Wood borer/? Oviposition Medium: Bark surfaces

2547 Chrysobothris gemmata LeConte [Coleoptera: Buprestidae] Immature/Adult Guild: Wood borer/? Oviposition Medium: Bark surfaces

2548 Chrysobothris merkelii Horn [Coleoptera: Buprestidae] Immature/Adult Guild: Wood borer/? Oviposition Medium: Bark surfaces

2549 Actenodes calcarata Chevrolat [Coleoptera: Buprestidae] Immature/Adult Guild: Wood borer/? Oviposition Medium: Bark surfaces

2550 Tyndaris olneyae Skinner [Coleoptera: Buprestidae] Immature/Adult Guild: Wood borer/? Oviposition Medium: Bark surfaces

2551 Solenopsis molesta Say (Bigelovia scale) [Hymenoptera: Formicidae]

2552 Crematogaster lineolata Say (Acrobat ant) [Hymenoptera: Formicidae] Immature/Adult Guild: ?/Aphid farmer

2553 Pheidole vinelandica longula Emery [Hymenoptera: Formicidae]

2554 Camponotus hyatti Emery [Hymenoptera: Formicidae]

2555 Lasius niger americanus Emery [Hymenoptera: Formicidae]

2556 Solenopsis molesta validuscula Emery [Hymenoptera: Formicidae]

2557 Camponotus maculatus vicinus-nitidiventris Emery (Maculate carpenter ant) [Hymenoptera: Formicidae]

2558 Formica neogagates neogagates Emery [Hymenoptera: Formicidae]

2559 Leptothorax curvispinosus rugatulus Emery [Hymenoptera: Formicidae]

2560 Lasius umbratus mixtus aphidicola Walsh [Hymenoptera: Formicidae]

2561 Formica sanguinea subnuda Emery (Sanguinary ant) [Hymenoptera: Formicidae]

2562 Trirhabda attenuata (Say) [Coleoptera: Chrysomelidae]

2563 Filatima spp. [Lepidoptera: Tortricidae]

2564 Anacamptodes clivinaria [Lepidoptera: Geometridae]

2565 Eutettix tenella Baker (Sugar beet leafhopper) [Homoptera: Cicadellidae] Immature/Adult Guild: Sap feeder/Sap feeder

2566 Macrosiphum longipes Gillette & Palmer [Homoptera: Aphididae]

2567 Macrosiphum glabrum Gillette & Palmer [Homoptera: Aphididae]

2568 Anuraphis minutissima Gillette & Palmer [Homoptera: Aphididae]

2569 Anuraphis filifoliae Gillette & Palmer [Homoptera: Aphididae]

2570 Anuraphis canae Will. [Homoptera: Aphididae]

2571 Anuraphis hermistonii Wilson [Homoptera: Aphididae]

2572 Xenylla maritima Tullberg (Maritime springtail) [Collembola: Poduridae]

2573 Pseudanurophorus spp. [Collembola: Isotomidae]

2574 Proisotoma decemoculata Folsom [Collembola: Isotomidae]

2575 Euthiscia tuberculata Van Duzee [Homoptera: Fulgoridae]

2576 Osbornia arborea Ball [Homoptera: Fulgoridae]

2577 Aphelonema solitaria Ball [Homoptera: Fulgoridae]

2578 Capitophorus brevinectarius Gillette & Palmer [Homoptera: Aphididae]

2579 Capitophorus heterohirsutus Gillette & Palmer [Homoptera: Aphididae]

2580 Capitophorus longinectarius Gillette & Palmer [Homoptera: Aphididae]

2581 Kakimia cerei Gillette & Palmer [Homoptera: Aphididae]

2582 Amphorophora brevitarsis Gillette & Palmer [Homoptera: Aphididae]

2583 Agrilus vittaticollis (Randall) [Coleoptera: Buprestidae] Oviposition Medium: Bark surfaces

2584 Magdalis salicis Horn [Coleoptera: Curculionidae]

2585 Prociphilus alnifoliae alnifoliae (Williams) [Homoptera: Aphididae]

2586 Phenacoccus dearnessi King [Homoptera: Coccidae]

2587 Apterona helix Siedbold [Lepidoptera: Psychidae]

2588 Archips cerasivorana (Fitch) (Cherry tree tortrix) [Lepidoptera: Tortricidae]

2589 Acmaeodera nexa Fall [Coleoptera: Buprestidae] Oviposition Medium: Bark surfaces

2590 Acmaeodera angelica Fall [Coleoptera: Buprestidae] Oviposition Medium: Bark surfaces

2591 Acmaeodera mariposa Horn [Coleoptera: Buprestidae] Oviposition Medium: Bark surfaces

2592 Acmaeodera vandykei Fall [Coleoptera: Buprestidae] Immature/Adult Guild: Wood borer/? Oviposition Medium: Bark surfaces

2593 Acmaeodera sinuata sexnotata Van Dyke [Coleoptera: Buprestidae] Oviposition Medium: Bark surfaces

2594 Anthaxia deleta deleta LeConte [Coleoptera: Buprestidae] Oviposition Medium: Bark surfaces

2595 Anoplodera crassipes LeConte [Coleoptera: Buprestidae] Oviposition Medium: Bark surfaces

2596 Asphondylia ceanothi Felt [Coleoptera: Cecidomyiidae]

2597 Euschistus conspersus Uhler (Consperse stink bug) [Hemiptera: Pentatomidae] Immature/Adult Guild: Fruit feeder/?

2598 Holcostethus abbreviatus (Uhler) [Hemiptera: Pentatomidae]

2599 Corythucha obliqua Osborn & Drake (Ceanothus tingid) [Hemiptera: Tingidae] Immature/Adult Guild: Sap feeder/Sap feeder

2600 Aphis ceanothi Clarke (Ceanothus aphid) [Homoptera: Aphididae] Immature/Adult Guild: Sap feeder: leaves,limbs,twigs/Sap feeder: leaves,limbs,twigs

2601 Clastoptera ovata Doering [Homoptera: Cercopidae]

2602 Pseudococcus maritimus (Ehrhorn) (Baker's or grape mealybug) [Homoptera: Coccidae]

2603 Puto albicans McKenzie [Homoptera: Coccidae]

2604 Rhizoecus bicirculus McKenzie [Homoptera: Coccidae]

2605 Spilococcus ceanothi McKenzie [Homoptera: Coccidae]

2606 Spilococcus quercinus McKenzie [Homoptera: Coccidae]

2607 Arytaina robusta Crawford [Homoptera: Psyllidae]

2608 Zaraea americana Cresson [Hymenoptera: Cimbicidae]

2609 Itame quadrilineata (Packard) [Lepidoptera: Geometridae]

2610 Nematocampa filamentaria Gn. [Lepidoptera: Geometridae]

2611 Scopula junctaria quinquelinearia (Packard) [Lepidoptera: Geometridae]

2612 Archips argyrospilus (Walker) (Fruit tree leaf roller) [Lepidoptera: Tortricidae]

2613 Acmaeodera knowltoni Barr [Coleoptera: Buprestidae] Oviposition Medium: Bark surfaces

2614 Acmaeodera idahoensis Fall [Coleoptera: Buprestidae] Oviposition Medium: Bark surfaces

2615 Anthaxia simiola Casey [Coleoptera: Buprestidae] Oviposition Medium: Bark surfaces

2616 Microphyllelus spp. [Hemiptera: Miridae]

2617 Psallus alnicola Douglas & Scott [Hemiptera: Miridae]

2618 Platypedia putnami (Uhler) (Putnam's cicada) [Hemiptera: Pentatomidae]

2619 Euphalerus adustus Tuthill [Homoptera: Psyllidae]

2620 Psylla acuta Crawford [Homoptera: Psyllidae]

2621 Psylla magna Crawford [Homoptera: Psyllidae]

2622 Marmopteryx animata Pears. [Lepidoptera: Geometridae]

2623 Acmaeodera purshiae Fisher [Coleoptera: Buprestidae] Oviposition Medium: Bark surfaces

2624 Chrysobothris deleta LeConte [Coleoptera: Buprestidae] Oviposition Medium: Bark surfaces

2625 Altica bimarginata Say [Coleoptera: Chrysomelidae] Immature/Adult Guild: Skeletonizer/Bud feeder,leaf perforator Overwintering Stage: Adults Oviposition Medium: Leaf,stem surfaces Generations Per Year: 1

2626 Cryptocephalus sanguinicollis sanguinicollis Suffrian [Coleoptera: Chrysomelidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

2627 Chrysomela lineatopunctata Forster [Coleoptera: Chrysomelidae]

2628 Triglyphulus spp. [Coleoptera: Curculionidae]

2629 Dasineura spp. [Coleoptera: Cecidomyiidae]

2630 Platypedia spp. (Woodland cicadas) [Homoptera: Cicadidae]

2631 Nysius angustatus Uhler (False chinch bug) [Hemiptera: Lygaeidae]

2632 Geocoris pullens Stal (Big-eyed bug) [Hemiptera: Lygaeidae] Immature/Adult Guild: Predator/Predator

2633 Adelphocoris rapidus (Say) [Hemiptera: Miridae]

2634 Atractotomus purshiae Froeschner [Hemiptera: Miridae]

2635 Capsus simulan (Stal) [Hemiptera: Miridae]

2636 Ceratocapsus spp. [Hemiptera: Miridae]

2637 Deraeocoris fulgidus (Van Duzee) [Hemiptera: Miridae]

2638 Labops hirtus Knight [Hemiptera: Miridae]

2639 Psallus pilosulus (Uhler) [Hemiptera: Miridae]

2640 Apateticus crocatus Uhler (Yellow bug) [Hemiptera: Pentatomidae]

2641 Brochymena quadripustulata (Fabricius) (Rough stink bug) [Hemiptera: Pentatomidae] Immature/Adult Guild: Predator/Predator

2642 Zicrona caerulea (Linnaeus) [Hemiptera: Pentatomidae]

2643 Eurygaster spp. [Hemiptera: Scutelleridae]

2644 Homaemus bijugis Uhler (Bijugate shield bug) [Hemiptera: Scutelleridae]

2645 Gargaphia opacula Uhler [Hemiptera: Tingidae] Immature/Adult Guild: Sap feeder/Sap feeder

2646 Macrosiphum avenae (Fabricius) [Homoptera: Aphididae]

2647 Macrosiphum purshiae Palmer [Homoptera: Aphididae]

2648 Aphrophora permutata Uhler (Rhubarb spittlebug) [Homoptera: Cercopidae]

2649 Erhthroneura spp. [Homoptera: Cicadellidae]

2650 Gyponana spp. [Homoptera: Cicadellidae]

2651 Neocoelidia spp. [Homoptera: Cicadellidae]

2652 Osbornellus borealis DeLong & Mohr [Homoptera: Cicadellidae]

2653 Paraphlepsius spp. [Homoptera: Cicadellidae]

2654 Scaphytopius spp. [Homoptera: Cicadellidae] Immature/Adult Guild: Stem feeder/Stem feeder

2655 Anisococcus quercus (Ehrhorn) [Homoptera: Coccidae]

2656 Phenacoccus eriogoni Ferris [Homoptera: Coccidae]

2657 Arytaina pubescens Crawford [Homoptera: Psyllidae]

2658 Psylla hirsuta (Tuthill) [Homoptera: Psyllidae]

2659 Psylla media Tuthill [Homoptera: Psyllidae]

2660 Crambus plumbifimbriellus Dyar [Lepidoptera: Pyralidae]

2661 Filatima nr. abactella [Lepidoptera: Gelechiidae]

2662 Chlorosea margaretaria Sperry [Lepidoptera: Geometridae]

2663 Chlorosea nevadaria Packard [Lepidoptera: Geometridae]

2664 Itame colata (Grote) [Lepidoptera: Geometridae]

2665 Marmopteryx marmorata Packard [Lepidoptera: Geometridae]

2666 Semiothisa californiaria (Packard) [Lepidoptera: Geometridae]

2667 Semiothisa denticulata sexpuncta Bates [Lepidoptera: Geometridae]

2668 Ephestiodes erythrella Ragonot [Lepidoptera: Pyralidae]

2669 Myelopsis coniella (Ragonot) [Lepidoptera: Pyralidae]

2670 Choristoneura rosaceana (Harr.) [Lepidoptera: Tortricidae]

2671 Sparganothis tunicana (Wism.) [Lepidoptera: Tortricidae]

2672 Trachoma walsinghamiella Bsk. [Lepidoptera: Yponomeutidae]

2673 Melanoplus sanguinipes sanguinipes (Fabricius) [Orthoptera: Acrididae]

2674 Oedaleonotus enigma (Scudder) (Valley grasshopper) [Orthoptera: Acrididae]

2675 Schistocerca lineata Scudder [Orthoptera: Acrididae]

2676 Agrilus politus Say [Orthoptera: Acrididae]

2677 Buprestis langi Mann. [Coleoptera: Buprestidae] Oviposition Medium: Bark surfaces

2678 Chrysobothris azurea LeConte [Coleoptera: Buprestidae] Oviposition Medium: Bark surfaces

2679 Chrysobothris femorata Olivier (Flat-headed apple tree borer) [Coleoptera: Buprestidae] Oviposition Medium: Bark surfaces

2680 Poecilonota fraseri Chamberlin [Coleoptera: Buprestidae] Oviposition Medium: Bark surfaces

2681 Anoplodera aspera (LeConte) [Coleoptera: Cerambycidae]

2682 Dendrobias mandibularis reductus Casey [Coleoptera: Cerambycidae]

2683 Hyperplatys spp. [Coleoptera: Cerambycidae]

2684 Ipochus fasciatus LeConte [Coleoptera: Cerambycidae]

2685 Malacopterus tenellus (Fabricius) [Coleoptera: Cerambycidae]

2686 Necydalis diversicollis Schaeffer [Coleoptera: Cerambycidae]

2687 Oberea quadricallosa LeConte (Cottonwood twig borer) [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer: live wood/?

2688 Phymatodes blandus (LeConte) [Coleoptera: Cerambycidae] Immature/Adult Guild: Stem borer/?

2689 Saperda spp. [Coleoptera: Cerambycidae]

2690 Stenosphenus nigricornis Fisher [Coleoptera: Cerambycidae]

2691 Stenosphenus debilis Horn [Coleoptera: Cerambycidae]

2692 Synaphaeta guexi (LeConte) (Spotted tree borer) [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer: dead,injured wood/?

2693 Xylotrechus insignis (LeConte) [Coleoptera: Cerambycidae]

2694 Xylotrechus mormonus (LeConte) [Coleoptera: Cerambycidae]

2695 Xylotrechus nunenmacheri Van Dyke [Coleoptera: Cerambycidae]

2696 Calligrapha verrucosa (Suffr.) [Coleoptera: Chrysomelidae]

2697 Chrysomela confluens Rogers [Coleoptera: Chrysomelidae]

2698 Anthonomus haematopus Boh. [Coleoptera: Curculionidae]

2699 Magdalis gracilis LeConte (Black fruit-tree weevil) [Coleoptera: Curculionidae] Immature/Adult Guild: Bud,flower,fruit feeder/?

2700 Cryptarcha ampla Er. [Coleoptera: Nitidulidae]

2701 Lobiopa undulata (Say) [Coleoptera: Nitidulidae]

2702 Cryphalus nitidus (Sw.) [Coleoptera: Scolytidae]

2703 Xyleborus saxeseni (Ratz.) (Lesser shothole borer) [Coleoptera: Scolytidae]

2704 Xyleborus dispar (Fabricius) (European shothole borer) [Coleoptera: Scolytidae]

2705 Agromyza spp. [Diptera: Agromyzidae]

2706 Mayetiola rigidae (Osten Sacken) [Diptera: Cecidomyiidae]

2707 Rhabdophaga spp. [Diptera: Cecidomyiidae]

2708 Corythucha salicata Gibson (Western willow tingid) [Hemiptera: Tingidae] Immature/Adult Guild: Sap feeder/Sap feeder

2709 Pseudococcus obscurus Essig (Baker's or grape mealybug) [Homoptera: Coccidae]

2710 Arge clavicornis (Fabricius) [Hymenoptera: Argidae]

2711 Cimbex americana Leach (Elm sawfly) [Hymenoptera: Cimbicidae] Immature/Adult Guild: Girdler/? Overwintering Stage: Larvae

2712 Caliroa labrata MacGillivray [Hymenoptera: Tenthredinidae]

2713 Euura breweriae E.L. Smith [Hymenoptera: Tenthredinidae]

2714 Euura exiquae E.L. Smith [Hymenoptera: Tenthredinidae]

2715 Euura geyerianae E.L. Smith [Hymenoptera: Tenthredinidae]

2716 Euura lasiolepis E.L. Smith [Hymenoptera: Tenthredinidae]

2717 Euura lemmoniae E.L. Smith [Hymenoptera: Tenthredinidae]

2718 Euura scoulerianae E.L. Smith [Hymenoptera: Tenthredinidae]

2719 Messa wuestneii (Kunow) [Hymenoptera: Tenthredinidae]

2720 Nematus chalceus (Marlatt) [Hymenoptera: Tenthredinidae]

2721 Nematus occidentalis (Marlatt) [Hymenoptera: Tenthredinidae]

2722 Nematus oligospilus Foerster [Hymenoptera: Tenthredinidae]

2723 Phyllocolpa spp. [Hymenoptera: Tenthredinidae]

2724 Pontania californica Marlatt (Willow leaf gall sawfly) [Hymenoptera: Tenthredinidae] Immature/Adult Guild: Gall former: leaves/?

2725 Pontania pacifica Marlatt [Hymenoptera: Tenthredinidae]

2726 Pristiphora spp. [Hymenoptera: Tenthredinidae]

2727 Trichiocampus irregularis (Dyar) [Hymenoptera: Tenthredinidae]

2728 Aegeria tibialis pacifica (Hy. Edw.) (Pacific poplar moth) [Lepidoptera: Sesiidae] Immature/Adult Guild: Wood borer/?

2729 Synanthedon albicornis (Hy. Edw.) [Lepidoptera: Sesiidae]

2730 Prionoxystus robiniae (Peck) (Carpenter worm) [Lepidoptera: Cossidae] Immature/Adult Guild: Wood borer/? Generations Per Year: 1/3

2731 Hemileuca maia (Drury) (Buck moth) [Lepidoptera: Saturniidae]

2732 Hemileuca nevadensis Stretch (Nevada buck moth) [Lepidoptera: Saturniidae] Immature/Adult Guild: Leaf feeder/?

2733 Puto yuccae Coquillet (Yucca mealybug) [Homoptera: Coccidae]

2734 Cimbex pacifica Cresson (Pacific sawfly) [Hymenoptera: Cimbicidae]

2735 Melanoplus bivittatus (Say) (Two-striped grasshopper) [Orthoptera: Acrididae] Immature/Adult Guild: Leaf feeder/Leaf feeder

2736 Anthaxia spp. [Coleoptera: Buprestidae] Immature/Adult Guild: Wood borer,girdler/Flower,leaf feeder Oviposition Medium: Bark surfaces

2737 Eutreta spp. (Gall forming fruit flies) [Diptera: Tephritidae] Immature/Adult Guild: Gall former/Gall former

2738 Hemileuca hera hera (=Pseudohazis) (Harris) (Great Basin day moth) [Lepidoptera: Saturniidae] Immature/Adult Guild: Leaf feeder/?

2739 Hemileuca nuttalli nuttalli (=Psueodhazis) (Strecker) (Nuttall's day moth) [Lepidoptera: Saturniidae] Immature/Adult Guild: Leaf feeder/?

2740 Trirhabda lewisii Crotch [Coleoptera: Chrysomelidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

2741 Aciurina spp. (Gall forming fruit flies) [Diptera: Tephritidae] Immature/Adult Guild: Gall former/Gall former

2742 Dicerca pectorosa LeConte [Coleoptera: Buprestidae] Immature/Adult Guild: Wood borer/Bark,leaf feeder Oviposition Medium: Bark surfaces

2743 Malacosoma constrictum (Henry Edwards) (Pacific tent caterpillar) [Lepidoptera: Lasiocampidae] Immature/Adult Guild: Leaf feeder/?

2744 Desmocerus spp. (Elderberry longhorned borers) [Coleoptera: Cerambycidae] Immature/Adult Guild: Root,stem borer/?

2745 Melanoplus devastator Scudder (Devastating grasshopper) [Orthoptera: Acrididae]

2746 Anacamptodes spp. [Lepidoptera: Geometridae]

2747 Anthaxia aeneogaster Castelnau & Gory (Common anthaxia) [Coleoptera: Buprestidae] Immature/Adult Guild: Girdler/? Oviposition Medium: Bark surfaces

2748 Chlorochroa spp. (Green stink bugs) [Hemiptera: Pentatomidae]

2749 Hemerocampa spp. [Lepidoptera: Liparidae]

2750 Hemerocampa vetusta Boisduvall [Lepidoptera: Liparidae] Immature/Adult Guild: Fruit,leaf feeder/? Overwintering Stage: Eggs Oviposition Medium: Bark,old cocoons Generations Per Year: 1

2751 Bucculatrix tridenticola Braun (Sagebrush leaf miner) [Lepidoptera: Lyonetiidae] Immature/Adult Guild: Leaf miner/?

2752 Rhophalomyia navasi Travares [Diptera: Cecidomyiidae] Immature/Adult Guild: Gall former/?

2753 Rhopalomyia ampullaris Felt [Diptera: Cecidomyiidae] Immature/Adult Guild: Gall former/?

2754 Diarthronomyia occidentalis Felt [Diptera: Cecidomyiidae] Immature/Adult Guild: Gall former/?

2755 Diarthronomyia artemisiae Felt (Artemisia gall midge) [Diptera: Cecidomyiidae] Immature/Adult Guild: Gall former/?

2756 Cecidomyia spp. [Diptera: Cecidomyiidae]

2757 Metatephritis fenestrata Foote [Diptera: Cecidomyiidae] Immature/Adult Guild: Gall former/?

2758 Melipotis fasciolaris Hubner [Lepidoptera: Noctuidae]

2759 Capnobotes fuliginosus (Thomas) [Orthoptera: Tettigoniidae] Immature/Adult Guild: Leaf feeder/?

2760 Bruchus amicus Horn [Coleoptera: Bruchidae] Immature/Adult Guild: Internal seed feeder/?

2761 Aneflus protensus LeConte (Mesquite branch borer) [Coleoptera: Buprestidae] Immature/Adult Guild: Wood borer/? Oviposition Medium: Bark surfaces

2762 Kalotermes simplicornia (Banks) (Desert damp-wood termite) [Isoptera: Kalotermitidae] Immature/Adult Guild: Termite/?

2763 Toumeyella mirabilis Cockerell [Homoptera: Coccidae] Immature/Adult Guild: Sap feeder/?

2764 Amphicerus punctipennis LeConte (Western twig borer) [Coleoptera: Bostrichidae] Immature/Adult Guild: Wood borer/?

2765 Diapheromera veliei veliei Walsh (Velie's walkingstick) [Orthoptera: Phasmatidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

2766 Diapheromera covilleae R. & H. [Orthoptera: Phasmatidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

2767 Bootettix argentatus argentinus Bruner (Creosote locust) [Orthoptera: Acrididae] Immature/Adult Guild: Leaf feeder/Leaf feeder

2768 Tachardiella larreae (Comstock) (Creosote lac scale) [Homoptera: Lacciferidae] Immature/Adult Guild: Sap feeder/Sap feeder

2769 Dactylopius coccus Costa [Homoptera: Dactylopiidae]

2770 Melitara prodenialis Walker [Lepidoptera: Pyralidae]

2771 Olycella junctolineela (Hulst) (Blue cactus borer) [Lepidoptera: Pyralidae] Immature/Adult Guild: Stem borer/?

2772 Chelinidea tabulata (Burmeister) (Cactus joint bug) [Hemiptera: Coreidae] Immature/Adult Guild: Sap feeder/Sap feeder Oviposition Medium: Cactus spines

2773 Chelinidea vittiger Uhler[Hamlin] [Hemiptera: Coreidae] Immature/Adult Guild: Sap feeder/Sap feeder

2774 Moneilema annulata Say [Coleoptera: Cerambycidae] Immature/Adult Guild: Stem borer/Cactus joint feeder

2775 Gelechia spp. [Lepidoptera: Gelechiidae]

2776 Tetrastichus nr. hibus [Hymenoptera: Eulophidae] Immature/Adult Guild: Endoparasite/?

2777 Eupelmus cyaniceps utahensis Girault [Hymenoptera: Eupelmidae] Immature/Adult Guild: Endoparasite/?

2778 Brachyrhinus ovatus (Linnaeus) (Strawberry root weevil) [Coleoptera: Curculionidae] Immature/Adult Guild: Root feeder/Fruit,leaf feeder

2779 Tetrastichus diarthronomyiae Gahan [Hymenoptera: Eulophidae] Immature/Adult Guild: Endoparasite/?

2780 Torymus nr. hircinus Ashmead [Hymenoptera: Torymidae] Immature/Adult Guild: Endoparasite/?

2781 Drosophila pseudoobscura [Diptera: Drosophilidae]

2782 Drosophila hamatofila [Diptera: Drosophilidae]

2783 Schistocerca obscura Fabricius [Orthoptera: Acrididae] Immature/Adult Guild: Leaf feeder/Leaf feeder

2784 Asilus occidentalis Hine [Diptera: Asilidae]

2785 Uclesia spp. [Diptera: Tachinidae]

2786 Emblethus vicarius Horv. [Hemiptera: Lygaeidae]

2787 Spacophilus spp. [Hymenoptera: Argidae]

2788 Xyalophora quinquelineata (Say) [Hymenoptera: Cynipidae]

2789 Cratacanthus dubinus Beauv. [Coleoptera: Carabidae]

2790 Cremastocheilus knocki LeConte [Coleoptera: Scarabaeidae]

2791 Cicindella formosa formosa Say [Coleoptera: Cicindelidae]

2792 Conoderus auritus Hbst. [Coleoptera: Elateridae]

2793 Aleochara montanicus Csy. [Coleoptera: Staphylinidae]

2794 Xenodusa reflexa Walker [Coleoptera: Staphylinidae]

2795 Eleodes tricostata robusta Blais. [Coleoptera: Tenebrionidae]

2796 Bruchus cruentatus Horn [Coleoptera: Bruchidae]

2797 Bruchus desertorum LeConte [Coleoptera: Bruchidae]

2798 Bruchus discolor Horn [Coleoptera: Bruchidae]

2799 Bruchus exiguus Horn [Coleoptera: Bruchidae]

2800 Bruchus mimus Horn [Coleoptera: Bruchidae]

2801 Bruchus prosopis LeConte [Coleoptera: Bruchidae]

2802 Bruchus protractus Horn [Coleoptera: Bruchidae]

2803 Bruchus sallaei Shp. [Coleoptera: Bruchidae]

2804 Bruchus uniformis LeConte [Coleoptera: Bruchidae]

2805 Bruchus spp. [Coleoptera: Bruchidae]

2806 Dactylopius spp. [Homoptera: Dactylopiidae]

2807 Morsea californica dumicola Rehn & Hebd. (Chaparral grasshopper) [Orthoptera: Acrididae]

2808 Anconia integra Sc. (Alkali grasshopper) [Orthoptera: Acrididae]

2809 Taeniopoda eques Burm. (Colonel) [Orthoptera: Acrididae]

2810 Aeoloplus chenopodii Br. (Salt-bush grasshopper) [Orthoptera: Acrididae]

2811 Aeoloplus tenuipennis Sc. (Athletic grasshopper) [Orthoptera: Acrididae]

2812 Poecilotettix sanguineus Sc. (Red-lined grasshopper) [Orthoptera: Acrididae]

2813 Perixerus gloriosus Hebd. (Gloriosa grasshopper) [Orthoptera: Acrididae]

2814 Bradynotes kaibab Hebd. (Brownie grasshopper) [Orthoptera: Acrididae]

2815 Melanoplus desultorius Rehn (Red whiskers) [Orthoptera: Acrididae]

2816 Melanoplus herbaceus Br. (Arrow-weed grasshopper) [Orthoptera: Acrididae]

2817 Chelinidea vittiger aequoris McAtee [Hemiptera: Coreidae]

2818 Chelinidea canyona Hamlin [Hemiptera: Coreidae]

2819 Oncideres texana Horn (Texas twig girdler) [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer,girdler/?

2820 Oncideres quercus Skinner (Arizona oak girdler) [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer,girdler/?

2821 Oncideres cingulata (Say) (Twig girdler) [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer,girdler/?

2822 Poliaenus negundo Schaeffer [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

2823 Brachystola magna (Girard) (Western lubber or jumbo grasshopper) [Orthoptera: Acrididae]

2824 Aulocara deorum (Scudder) [Orthoptera: Acrididae]

2825 Schistocerca damnifica (Saussure) [Orthoptera: Acrididae]

2826 Schistocerca alutacea (Harris) [Orthoptera: Acrididae]

2827 Pterophylla spp. [Orthoptera: Tettigoniidae]

2828 Microcentrum rhombifolium (Saussure) [Orthoptera: Tettigoniidae]

2829 Apote notabilis Scudder (Notable shield bearer) [Orthoptera: Tettigoniidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

2830 Trimerotropis caeruleipennis Bruner [Orthoptera: Acrididae] Immature/Adult Guild: Leaf feeder/Leaf feeder

2831 Conozoa wallula (Scudder) [Orthoptera: Acrididae] Immature/Adult Guild: Leaf feeder/Leaf feeder

2832 Melanoplus cinereus Scudder (Rusty locust) [Orthoptera: Acrididae] Immature/Adult Guild: Leaf feeder/Leaf feeder

2833 Melanoplus yarrowii (Thomas) [Orthoptera: Acrididae] Immature/Adult Guild: Leaf feeder/Leaf feeder

2834 Aedes aegypti (Linnaeus) (Yellow-fever mosquito) [Diptera: Culicidae] Immature/Adult Guild: ?/Animal disease vector

2835 Acanthoscelides floridae (Horn) [Coleoptera: Bruchidae] Immature/Adult Guild: Internal seed feeder/?

2836 Walshia amorphella (Clem.) (False indigo gall moth) [Lepidoptera: Pterophoridae] Immature/Adult Guild: Gall former/?

2837 Microgaster ecdytolophae Mues. [Hymenoptera: Braconidae] Immature/Adult Guild: Endoparasite/?

2838 Prisotmerus euryptychiae Ashmead [Hymenoptera: Ichneumonidae] Immature/Adult Guild: Endoparasite/?

2839 Horismenus missouriensis (Ashmead) [Hymenoptera: Eulophidae] Immature/Adult Guild: Endoparasite/?

2840 Eupelmus cyaniceps amicus (Gir.) [Hymenoptera: Eupelmidae] Immature/Adult Guild: Endoparasite/?

2841 Dolichomitus messor sparsus Townes [Hymenoptera: Ichneumonidae] Immature/Adult Guild: Endoparasite/?

2842 Euderus argyresthiae (Crawford) [Hymenoptera: Eulophidae] Immature/Adult Guild: Endoparasite/?

2843 Odinia xanthocera Collin [Diptera: Odiniidae]

2844 Polycesta arizonica Schaeffer [Coleoptera: Buprestidae] Immature/Adult Guild: Wood borer/? Oviposition Medium: Bark surfaces

2845 Arethaca ambulator Hebard [Orthoptera: Tettigoniidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

2846 Pediodectes haldemanii (Girard) [Orthoptera: Tettigoniidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

2847 Drosophila melanogaster [Diptera: Drosophilidae]

2848 Chrysobothris cyanella Horn [Coleoptera: Buprestidae] Immature/Adult Guild: Wood borer/? Oviposition Medium: Bark surfaces

2849 Melanoplus ponderosus ponderosus Scudder [Orthoptera: Acrididae] Immature/Adult Guild: Flower,fruit feeder/Flower,fruit feeder

2850 Campylacantha olivacea olivacea (Scudder) [Orthoptera: Acrididae] Immature/Adult Guild: Flower,fruit feeder/Flower,fruit feeder

2851 Trimerotropis pistrinaria Saussure [Orthoptera: Acrididae] Immature/Adult Guild: Leaf feeder/Leaf feeder

2852 Paraidemona punctata (Stal) [Orthoptera: Acrididae] Immature/Adult Guild: Leaf feeder/Leaf feeder

2853 Melanoplus texanus Scudder [Orthoptera: Acrididae] Immature/Adult Guild: Leaf feeder/Leaf feeder

2854 Dactylotum pictum (Thomas) (Barber pole grasshopper) [Orthoptera: Acrididae] Immature/Adult Guild: Leaf feeder/Leaf feeder

2855 Hesperotettix speciosus (Scudder) [Orthoptera: Acrididae] Immature/Adult Guild: Leaf feeder/Leaf feeder

2856 Hypochlora alba (Dodge) [Orthoptera: Acrididae] Immature/Adult Guild: Leaf feeder/Leaf feeder

2857 Dasyneura lupini Felt [Diptera: Cecidomyiidae] Immature/Adult Guild: Gall former/?

2858 Asphondylia shepherdiae Felt [Diptera: Cecidomyiidae] Immature/Adult Guild: Gall former/?

2859 Glaucopsyche lygdamus (Doubleday) [Lepidoptera: Lycaenidae] Immature/Adult Guild: Flower feeder/?

2860 Phaonia spp. [Diptera: Muscidae]

2861 Thoracaphis distyliifoliae Takahashi [Homoptera: Aphididae]

2862 Thoracaphis cuspidata (Essig & Kuwana) [Homoptera: Aphididae]

2863 Thoracaphis quercicola Takahashi [Homoptera: Aphididae]

2864 Thoracaphis umbellulariae Essig [Homoptera: Aphididae]

2865 Papilio eurymedon Boisduvall or Lucas (?) (Eurymedon) [Lepidoptera: Papilionidae]

2866 Papilio indra indra Reakirt [Lepidoptera: Papilionidae]

2867 Papilio bairdii W.H. Edwards [Lepidoptera: Papilionidae]

2868 Papilio oregonius Edwards [Lepidoptera: Papilionidae]

2869 Halictus aberrans Crawford [Hymenoptera: Halictidae]

2870 Asterolecanium arabidis (Signoret) (Pit-making pittosporum scale) [Homoptera: Coccidae]

2871 Periploca ceanothiella (Cosens) (Ceanothus stem-gall moth) [Lepidoptera: Gelechiidae]

2872 Pristomerus baumhoferi Cush. [Hymenoptera: Ichneumonidae] Immature/Adult Guild: Endoparasite/?

2873 Scambus aplopappi (Ashmead) [Hymenoptera: Ichneumonidae] Immature/Adult Guild: Endoparasite/?

2874 Apistephialtes nucicola (Cush.) [Hymenoptera: Ichneumonidae] Immature/Adult Guild: Endoparasite/?

2875 Gargaphia angulata Heidemann (Angulate tingid) [Hemiptera: Tingidae] Immature/Adult Guild: Sap feeder/Sap feeder

2876 Gargaphia solani Heidemann (Eggplant lacebug) [Hemiptera: Tingidae] Immature/Adult Guild: Sap feeder/Sap feeder

2877 Gargaphia iridescens Champion (Iridescent lacebug) [Hemiptera: Tingidae] Immature/Adult Guild: Sap feeder/Sap feeder

2878 Pelecyphorus spp. (Darkling beetles) [Coleoptera: Tenebrionidae]

2879 Stenomorpha puncticollis LeConte [Coleoptera: Tenebrionidae]

2880 Schizura ipomaeae Doubleday [Lepidoptera: Notodontidae] Immature/Adult Guild: Leaf feeder/?

2881 Psylla uncatoides (Ferris & Klyver) [Homoptera: Psyllidae] Immature/Adult Guild: Sap feeder/Sap feeder

2882 Metcalfa pruinosa (Say) [Homoptera: Flatidae] Immature/Adult Guild: Sap feeder/Sap feeder

2883 Psilodryinus typhlocybae (Ashmead) [Hymenoptera: Dryinidae] Immature/Adult Guild: Endoparasite/?

2884 Labeo typhlocybae Ashmead [Hymenoptera: Dryinidae] Immature/Adult Guild: Endoparasite/?

2885 Nepticula ceanothi Braun (Ceanothus leaf miner) [Lepidoptera: Nepticulidae] Immature/Adult Guild: Leaf miner/?

2886 Plebejus icarioides (Boisduval) (Blue butterfly) [Lepidoptera: Lycaenidae] Immature/Adult Guild: Leaf feeder/?

2887 Eumysia spp. (Snout moth) [Lepidoptera: Pyralidae]

2888 Parabacillus coloradus (Scudder) [Orthoptera: Phasmatidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

2889 Pseudosermyle straminea (Scudder) [Orthoptera: Phasmatidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

2890 Derotmema haydenii haydenii (Walsh) [Orthoptera: Phasmatidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

2891 Mestobregma plattei corrugata (Scudder) [Orthoptera: Acrididae] Immature/Adult Guild: Leaf feeder/Leaf feeder

2892 Trimerotropis texana (Bruner) [Orthoptera: Acrididae] Immature/Adult Guild: Leaf feeder/Leaf feeder

2893 Trimerotropis gracilis gracilis (Thomas) [Orthoptera: Acrididae] Immature/Adult Guild: Leaf feeder/Leaf feeder

2894 Trimerotropis laticincta Saussure [Orthoptera: Acrididae] Immature/Adult Guild: Leaf feeder/Leaf feeder

2895 Trimerotropis sparsa (Thomas) [Orthoptera: Acrididae] Immature/Adult Guild: Leaf feeder/Leaf feeder

2896 Hesperotettix viridis viridis (Thomas) [Orthoptera: Acrididae] Immature/Adult Guild: Leaf feeder/Leaf feeder

2897 Melanoplus bowditchi bowditchi Scudder [Orthoptera: Acrididae] Immature/Adult Guild: Leaf feeder/Leaf feeder

2898 Eremopedes scudderi Cockerell [Orthoptera: Tettigoniidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

2899 Oecanthus californicus pictipennis Hebard [Orthoptera: Gryllidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

2900 Epochra canadensis (Loew) (Currant or gooseberry fruit fly) [Diptera: Tephritidae] Immature/Adult Guild: Fruit feeder/? Overwintering Stage: Pupae in soil Oviposition Medium: Fruit Generations Per Year: 1

2901 Rhagoletis pomonella (Walsh) (Apple maggot or blueberry maggot) [Diptera: Tephritidae] Immature/Adult Guild: Fruit feeder/?

2902 Cryptorrhynchus lapathi Linnaeus (Poplar and willow borer) [Coleoptera: Curculionidae] Immature/Adult Guild: Wood borer/?

2903 Spharagemon inornatum Morse [Orthoptera: Acrididae] Immature/Adult Guild: Leaf feeder/Leaf feeder

2904 Evylaeus galpinsiae Cockerell [Hymenoptera: Halictidae] Immature/Adult Guild: ?/Nectar,pollen feeder

2905 Desmocerus piperi Webb [Coleoptera: Cerambycidae] Immature/Adult Guild: Root,stem borer/?

2906 Stictocephala festina Say (Three-cornered alfalfa hopper) [Homoptera: Membracidae] Immature/Adult Guild: Sap feeder/Sap feeder

2907 Archips negundanus (Dyar) [Lepidoptera: Tortricidae] Immature/Adult Guild: Leaf feeder/?

2908 Drosophila spp. [Diptera: Drosophilidae]

2909 Coleophora atriplicivora Cockerell (Atriplex case-bearing moth) [Lepidoptera: Coleophoridae]

2910 Choristoneura fractivittana Clemens [Lepidoptera: Tortricidae] Immature/Adult Guild: Leaf feeder/?

2911 Archips georgianus Walker [Lepidoptera: Tortricidae] Immature/Adult Guild: Leaf feeder/?

2912 Choristoneura parallela Robinson [Lepidoptera: Tortricidae] Immature/Adult Guild: Leaf feeder/?

2913 Choristoneura obsoletana Walker [Lepidoptera: Tortricidae] Immature/Adult Guild: Leaf feeder/?

2914 Pandemus pyrusana Kearfott [Lepidoptera: Tortricidae] Immature/Adult Guild: Leaf feeder/?

2915 Clepsis persicana Fitch [Lepidoptera: Tortricidae] Immature/Adult Guild: Leaf feeder/?

2916 Eutettix tenellus (Baker) (Sugar beet leafhopper) [Homoptera: Cicadellidae] Immature/Adult Guild: Sap feeder/Sap feeder

2917 Orthezia spp. [Homoptera: Ortheziidae] Immature/Adult Guild: Sap feeder/Sap feeder

2918 Trissolcus spp. [Hymenoptera: Scelionidae]

2919 Dorymyrmex pyramicus (Roger) [Hymenoptera: Formicidae]

2920 Formica lasioides Emery [Hymenoptera: Formicidae]

2921 Agathis gibbosa (Say) [Hymenoptera: Braconidae]

2922 Coleophora sacramenta (Heinrich) (California case-bearer) [Lepidoptera: Coleophoridae] Overwintering Stage: Larvae Generations Per Year: 1

2923 Anacamptodes animata profanata (Guen.) (Mountain mahogany looper) [Lepidoptera: Geometridae] Immature/Adult Guild: Leaf feeder/?

2924 Eremopedes covillae [Orthoptera: Tettigoniidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

2925 Paracyrtophyllus excelsus (Rehn & Hebard) [Orthoptera: Tettigoniidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

2926 Scaphytopius acutus (Say) [Homoptera: Cicadellidae] Immature/Adult Guild: Plant disease vector/Plant disease vector

2927 Keonolla confluens (Uhler) [Homoptera: Cicadellidae] Immature/Adult Guild: Plant disease vector/Plant disease vector

2928 Platylyra californica Scudder [Orthoptera: Tettigoniidae]

2929 Forficula auricularis Linnaeus [Dermaptera: Forficulidae]

2930 Psocus confraternus Banks [Psocoptera: Psocidae]

2931 Caecilius spp. [Psocoptera: Pseudocaeciliidae]

2932 Liposcelis spp. [Psocoptera: Trogiidae]

2933 Taeniothrips ehrhorni Moulton [Thysanoptera: Thripidae]

2934 Isoneurothrips australis Bagnall [Thysanoptera: Thripidae]

2935 Leptothrips mali (Fitch) [Thysanoptera: Phlaeothripidae]

2936 Thyantis custator (Fabricius) [Hemiptera: Pentatomidae]

2937 Perillus splendidus Uhler [Hemiptera: Pentatomidae]

2938 Arhyssus crassus Horvath [Hemiptera: Coreidae]

2939 Rhyparochromus chiragra californica Van Duzee [Hemiptera: Lygaeidae]

2940 Pselliopus spinicollis Champion [Hemiptera: Reduviidae]

2941 Irbisia solani Heidemann [Hemiptera: Miridae]

2942 Irbisia californica Van Duzee [Hemiptera: Miridae]

2943 Irbisia spp. [Hemiptera: Miridae]

2944 Lygus sallei Stal [Hemiptera: Miridae]

2945 Parthenicus brunneus Van Duzee [Hemiptera: Miridae]

2946 Danepteryx manca Uhler [Homoptera: Issidae]

2947 Dictyobia spp. [Homoptera: Issidae]

2948 Oecleus spp. [Homoptera: Cixiidae]

2949 Cixius cultus Ball (Cult fulgorid) [Homoptera: Cixiidae]

2950 Okanagana vanduzeei Distant [Homoptera: Cicadidae]

2951 Ceresa franciscana Stal [Homoptera: Membracidae]

2952 Ceresa albidosparsa Stal [Homoptera: Membracidae]

2953 Stictocephalus pacifica Van Duzee [Homoptera: Membracidae]

2954 Philya californica (Goding) [Homoptera: Membracidae]

2955 Aphrophora spp. [Homoptera: Cercopidae]

2956 Tiaja californica (Ball) [Homoptera: Cicadellidae]

2957 Cochlorhinus pluto Uhler [Homoptera: Cicadellidae]

2958 Lystridea uhleri (Baker) [Homoptera: Cicadellidae]

2959 Pagaronia triunata Ball [Homoptera: Cicadellidae]

2960 Neokolla gothica (Signoret) [Homoptera: Cicadellidae]

2961 Aceratagallia californica (Baker) [Homoptera: Cicadellidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

2962 Neocoelidia obscura Baker [Homoptera: Cicadellidae]

2963 Empoasca cerea DeLong [Homoptera: Cicadellidae]

2964 Stragania franciscana (Baker) [Homoptera: Cicadellidae]

2965 Ballana mera DeLong [Homoptera: Cicadellidae]

2966 Colladonus montanus (Van Duzee) [Homoptera: Cicadellidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

2967 Deltocephalus fuscinervosus Van Duzee [Homoptera: Cicadellidae]

2968 Euscelis schenkii (Kirschbaum) [Homoptera: Cicadellidae]

2969 Paraphlepsius apertinus Osborn & Lathrop [Homoptera: Cicadellidae]

2970 Paraphlepsius occidentalis (Baker) [Homoptera: Cicadellidae]

2971 Trioza collaris Crawford [Homoptera: Chermidae]

2972 Aleyrodes amnicola Bemis [Homoptera: Aleyrodidae]

2973 Agalliopsis oculata (Van Duzee) [Homoptera: Cicadellidae]

2974 Aleyrodes spiraeoides Bemis or Quaintance (Iris whitefly) [Homoptera: Aleyrodidae]

2975 Tetraleurodes errans (Bemis) (Laurel whitefly) [Homoptera: Aleyrodidae]

2976 Lecanium corni Bouche (Brown apricot scale) [Homoptera: Coccidae]

2977 Saissetia oleae (Bernard) (Black scale) [Homoptera: Coccidae]

2978 Hemerobius pacificus Banks [Neuroptera: Hemerobiidae]

2979 Eremochrysa californica Banks [Neuroptera: Chrysopidae]

2980 Chrysopa cockerelli Banks [Neuroptera: Chrysopidae]

2981 Chrysopa ploripunda Fitch [Neuroptera: Chrysopidae]

2982 Mantispilla spp. [Neuroptera: Mantispidae]

2983 Agulla adnixa Hagen [Neuroptera: Raphididae]

2984 Agulla assimilis (Albarda) [Neuroptera: Raphididae]

2985 Apterobittacus apterus (McLachlan) [Mecoptera: Bittacidae]

2986 Peridroma margaritosa (Haworth) [Lepidoptera: Noctuidae]

2987 Adelphagrotis indeterminata Walker [Lepidoptera: Noctuidae]

2988 Tricholita chipeta endiva Smith [Lepidoptera: Noctuidae]

2989 Dryotype opina (Grote) [Lepidoptera: Noctuidae]

2990 Merochlora faseolaria (Guenee) [Lepidoptera: Geometridae]

2991 Elpiste marcescaria (Guenee) [Lepidoptera: Geometridae]

2992 Sablodes caberata (Guenee) [Lepidoptera: Geometridae]

2993 Synaxis fuscata Hulst [Lepidoptera: Geometridae]

2994 Prochoerodes truxaliata (Guenee) [Lepidoptera: Geometridae]

2995 Oidaematophorus confusus Braun [Lepidoptera: Pterophoridae]

2996 Oidaematophorus grandis (Fish) [Lepidoptera: Pterophoridae]

2997 Argyrotaenia citrana Fernald [Lepidoptera: Tortricidae] Immature/Adult Guild: Leaf feeder/?

2998 Henricus saxicolanus (Walsingham) [Lepidoptera: Phaloniidae]

2999 Aristotelia argentifera Busck [Lepidoptera: Gelechiidae]

3000 Recurvaria bacchariella Keifer [Lepidoptera: Gelechiidae]

3001 Gnorimoschema baccharisella Busck (Strawberry crown miner) [Lepidoptera: Gelechiidae] Immature/Adult Guild: Gall former: stems/?

3002 Coleophora viscidiflorella Walsingham [Lepidoptera: Coleophoridae]

3003 Coleophora lynosyridella Walsingham [Lepidoptera: Coleophoridae]

3004 Cremastobombycia solidaginis (Frey & Boll) [Lepidoptera: Gracilariidae]

3005 Bucculatrix variabilis Braun [Lepidoptera: Lyonetiidae]

3006 Oinophila v-flavum (Haworth) [Lepidoptera: Oinophilidae]

3007 Lebia cyanipennis DeJean [Coleoptera: Carabidae]

3008 Lebia cyanipennis ruficollis LeConte [Coleoptera: Carabidae]

3009 Podabrus pruinosus LeConte [Coleoptera: Cantharidae]

3010 Podabrus macer LeConte [Coleoptera: Cantharidae]

3011 Podabrus modulatus Fall [Coleoptera: Cantharidae]

3012 Cantharis divisus LeConte [Coleoptera: Cantharidae]

3013 Cantharis ochropus LeConte [Coleoptera: Cantharidae]

3014 Malachius horni Fall [Coleoptera: Melyridae]

3015 Microlipus franciscanus Fall [Coleoptera: Melyridae]

3016 Pseudebaeus bicolor LeConte [Coleoptera: Melyridae]

3017 Attalus glabrellus Fall [Coleoptera: Melyridae]

3018 Attalus lobulatus LeConte [Coleoptera: Melyridae]

3019 Listus pardalis Casey [Coleoptera: Melyridae]

3020 Phyllobaenus scabra (LeConte) [Coleoptera: Cleridae]

3021 Phyllobaenus occidentalis (Chapin) [Coleoptera: Cleridae]

3022 Pedius inconspicuus flavidus Fall [Coleoptera: Pedilidae]

3023 Lappus nitidulus LeConte [Coleoptera: Anthicidae]

3024 Limonius maculicollis Motschulsky [Coleoptera: Elateridae]

3025 Dolopius lateralis Eschscholtz [Coleoptera: Elateridae]

3026 Agriotes imperfectus LeConte [Coleoptera: Elateridae]

3027 Cardiophorus tenebrosus flavipes LeConte [Coleoptera: Elateridae]

3028 Dascillus davidsoni LeConte (Davidson's beetle) [Coleoptera: Dascillidae] Immature/Adult Guild: Root feeder/?

3029 Cyphon concinnus (LeConte) [Coleoptera: Helodidae]

3030 Byturus grisescens Jayne [Coleoptera: Byturidae]

3031 Perimegatoma jaynei Casey [Coleoptera: Dermestidae]

3032 Melanophthalma villosa Zimmermann [Coleoptera: Lathridiidae]

3033 Hyperaspis quadriloculatus Motschulsky [Coleoptera: Coccinellidae]

3034 Scymnus guttulatus LeConte [Coleoptera: Coccinellidae]

3035 Scymnus nebulosus LeConte [Coleoptera: Coccinellidae]

3036 Rhizobius ventralis (Erichson) [Coleoptera: Coccinellidae]

3037 Psyllobora vigintimaculata taedata LeConte [Coleoptera: Coccinellidae]

3038 Coccinella trifasciata juliana Mulsant [Coleoptera: Coccinellidae]

3039 Coccinella californica Mannerheim [Coleoptera: Coccinellidae]

3040 Cycloneda munda polita Casey [Coleoptera: Coccinellidae]

3041 Chilocorus bivulnerus Mulsant [Coleoptera: Coccinellidae]

3042 Chrysobothris bacchari Van Dyke [Coleoptera: Buprestidae] Immature/Adult Guild: Wood borer: dead wood/? Oviposition Medium: Bark surfaces

3043 Exochomus quatuorpustulatus quadrimaculatus Barovsky [Coleoptera: Coccinellidae]

3044 Stenochidus gracilis LeConte [Coleoptera: Alleculidae]

3045 Ptinus cognata Fall [Coleoptera: Ptinidae]

3046 Ozognathus cornutus (LeConte) [Coleoptera: Anobiidae]

3047 Psoa maculata LeConte (Spotted limb borer) [Coleoptera: Bostrichidae] Immature/Adult Guild: Wood borer: dead wood/?

3048 Pachybrachis hybridus Suffrian [Coleoptera: Chrysomelidae]

3049 Cryptocephalus sanguinicollis nigerrimus Crotch [Coleoptera: Chrysomelidae]

3050 Trirhabda flavolimbata (Mannerheim) [Coleoptera: Chrysomelidae]

3051 Acalymma trivittata (Mannerheim) [Coleoptera: Chrysomelidae]

3052 Mylabris pruininus Horn (Pruinose weevil) [Coleoptera: Bruchidae] Immature/Adult Guild: ?/Pollen feeder

3053 Sciopithes obscurus Horn [Coleoptera: Curculionidae]

3054 Sciopithes arcuatus Casey [Coleoptera: Curculionidae]

3055 Smicronyx cinereus Motschulsky [Coleoptera: Curculionidae]

3056 Camploplegidea spp. [Hymenoptera: Ichneumonidae]

3057 Cryptohelcostizus alamedensis (Ashmead) [Hymenoptera: Ichneumonidae]

3058 Diplazon laetatorius (Fabricius) [Hymenoptera: Ichneumonidae]

3059 Horogenes eureka (Ashmead) [Hymenoptera: Ichneumonidae]

3060 Horogenes pterophorae (Ashmead) [Hymenoptera: Ichneumonidae]

3061 Iseropus spp. [Hymenoptera: Ichneumonidae]

3062 Mesochorus spp. [Hymenoptera: Ichneumonidae]

3063 Phoeogenes spp. [Hymenoptera: Ichneumonidae]

3064 Pimplopterus spp. [Hymenoptera: Ichneumonidae]

3065 Scambus pterophori (Ashmead) [Hymenoptera: Ichneumonidae]

3066 Apanteles aristoteliae Viereck [Hymenoptera: Braconidae]

3067 Aphidius rosae Haliday [Hymenoptera: Braconidae]

3068 Bucculatriplex spp. [Hymenoptera: Braconidae]

3069 Eubadizon spp. [Hymenoptera: Braconidae]

3070 Hormius pallidipes (Ashmead) [Hymenoptera: Braconidae]

3071 Microbracon melanaspis (Ashmead) [Hymenoptera: Braconidae]

3072 Microbracon spp. [Hymenoptera: Braconidae]

3073 Torymus baccharidis (Huber) [Hymenoptera: Torymidae]

3074 Amblymerus spp. [Hymenoptera: Pteromalidae]

3075 Bothriencyrtus planiformis (Howard) [Hymenoptera: Encyrtidae]

3076 Copidosoma spp. [Hymenoptera: Encyrtidae]

3077 Eupelmus inyoensis Girault [Hymenoptera: Eupelmidae]

3078 Eupelmus cyaniceps Ashmead [Hymenoptera: Eupelmidae]

3079 Sympiesis stigmatus Girault [Hymenoptera: Eulophidae]

3080 Goniozus spp. [Hymenoptera: Bethylidae]

3081 Crematogaster coarctata Mayr [Hymenoptera: Formicidae]

3082 Iridomyrmex humilis Mayr [Hymenoptera: Formicidae]

3083 Prenolepsis imparis (Say) [Hymenoptera: Formicidae]

3084 Formica rufibarbis occidua Wheeler [Hymenoptera: Formicidae]

3085 Rhopalomyia californica Felt [Diptera: Cecidomyiidae] Immature/Adult Guild: Gall former: shoots/?

3086 Clinodiplosus pucciniae Pritchard [Diptera: Cecidomyiidae]

3087 Stratiomya maculosa Loew [Diptera: Stratiomyidae]

3088 Aciurina thoracica Curran [Diptera: Tephritidae]

3089 Drosophila obscura Fallen [Diptera: Drosophilidae]

3090 Liriomyza pusilla (Meigen) [Diptera: Agromyzidae]

3091 Leptogaster brevicornis Loew [Diptera: Asilidae]

3092 Paramuscopteryx genalis Townsend [Diptera: Tachinidae]

3093 Voria ruralis Fallen [Diptera: Tachinidae]

3094 Xanthophyto spp. [Diptera: Tachinidae]

3095 Diabrotica undecimpunctata (Mannerheim) [Coleoptera: Chrysomelidae] Immature/Adult Guild: ?/Flower,leaf feeder

3096 Coenonycha bowlesi Cazier [Coleoptera: Scarabaeidae] Immature/Adult Guild: ?/Leaf feeder

3097 Coenonycha testacea Cazier [Coleoptera: Scarabaeidae] Immature/Adult Guild: ?/Leaf feeder

3098 Plebejus icarioides pheres (Boisduvall) [Lepidoptera: Lycaenidae]

3099 Plebejus icarioides missionensis Esch. [Lepidoptera: Lycaenidae]

3100 Aglais californica Boisduvall (California tortoise-shell) [Lepidoptera: Nymphalidae] Immature/Adult Guild: Leaf feeder/Nectar feeder

3101 Camnula pellucida (Clearwinged grasshopper) [Orthoptera: Acrididae] Immature/Adult Guild: Leaf feeder/Leaf feeder

3102 Dissosteira spurcata [Orthoptera: Acrididae] Immature/Adult Guild: Leaf feeder/Leaf feeder

3103 Pterochlorus rosae (Cholodkovsky) [Homoptera: Aphididae] Immature/Adult Guild: Bark feeder/Bark feeder

3104 Aphis chrysothamnicola infrequens Knowlton [Homoptera: Aphididae] Immature/Adult Guild: Sap feeder/Sap feeder

3105 Amphorophora accidentalis Knowlton [Homoptera: Aphididae] Immature/Adult Guild: Sap feeder/Sap feeder

3106 Amphorophora aridus Knowlton [Homoptera: Aphididae] Immature/Adult Guild: Sap feeder/Sap feeder

3107 Mucrotrichaphis toti Knowlton & Allen [Homoptera: Aphididae] Immature/Adult Guild: Sap feeder/Sap feeder

3108 Mucrotrichaphis albicornus Knowlton & Allen [Homoptera: Aphididae]

3109 Mucrotrichaphis anomellus (Knowlton & Allen) [Homoptera: Aphididae]

3110 Mucrotrichaphis zerohypsi Knowlton & Allen [Homoptera: Aphididae]

3111 Mucrotrichaphis flavilla Knowlton & Allen [Homoptera: Aphididae]

3112 Cacama crepitans Van Duzee (Crackling cicada) [Homoptera: Cicadidae]

3113 Clidophelps pallida Van Duzee [Homoptera: Cicadidae]

3114 Okanagana gracilis Davis [Homoptera: Cicadidae]

3115 Okanagana bella Davis [Homoptera: Cicadidae]

3116 Okanagana luteobasalis Davis [Homoptera: Cicadidae]

3117 Okanagana utahensis Davis [Homoptera: Cicadidae]

3118 Okanagana fumipennis Davis [Homoptera: Cicadidae]

3119 Neoplatypedia constricta Davis [Homoptera: Cicadidae]

3120 Merobruchus major (Horn) [Coleoptera: Bruchidae]

3121 Microsiphum acophorum Smith & Knowlton [Homoptera: Aphididae]

3122 Microsiphum artemisiae (Gillette) [Homoptera: Aphididae]

3123 Asphondylia opuntiae Felt [Diptera: Cecidomyiidae]

3124 Narnia inornata Distant [Hemiptera: Coreidae] Immature/Adult Guild: Cactus joint feeder/Cactus joint feeder

3125 Ozamia fuscomaculella (Wright) [Lepidoptera: Pyralidae]

3126 Marmara opuntiella Busck [Lepidoptera: Gracilariidae]

3127 Volucella marginata Say [Diptera: Syrphidae]

3128 Volucella lutzi Curran [Diptera: Syrphidae]

3129 Volucella mexicana Macquart [Diptera: Syrphidae]

3130 Volucella nigra Greene [Diptera: Syrphidae]

3131 Volucella tau Bigot [Diptera: Syrphidae]

3132 Melitara spp. [Lepidoptera: Pyralidae]

3133 Onodiplosis sarcobati Felt [Diptera: Cecidomyiidae]

3134 Asphondylia adenostoma Felt [Diptera: Cecidomyiidae]

3135 Asteromyia gutierreziae Felt [Diptera: Cecidomyiidae]

3136 Rhopalomyia salviae Felt [Diptera: Cecidomyiidae]

3137 Rhopalomyia ampullaria Felt [Diptera: Cecidomyiidae]

3138 Rhopalomyia utahensis Felt [Diptera: Cecidomyiidae]

3139 Rhopalomyia chrysothamni Felt [Diptera: Cecidomyiidae]

3140 Rhopalomyia glutinosa Felt [Diptera: Cecidomyiidae]

3141 Phytophaga wellsi Felt [Diptera: Cecidomyiidae]

3142 Phytophaga timberlakei Felt [Diptera: Cecidomyiidae]

3143 Forda olivacea Rohrwer [Homoptera: Aphididae]

3144 Zygogramma conjuncta Rogers [Coleoptera: Scarabaeidae]

3145 Corizus tuberculatus Hambl. [Hemiptera: Coreidae]

3146 Jalysus spinosus (Say) [Hemiptera: Berytidae]

3147 Phlepsius extremus Ball [Homoptera: Cicadellidae]

3148 Opsius clarivadus (Van Duzee) [Homoptera: Cicadellidae]

3149 Neothomasia salicinigra Knowlton [Homoptera: Aphididae]

3150 Neothomasia utahensis Knowlton [Homoptera: Aphididae]

3151 Neothomasia populicola (Thomas) [Homoptera: Aphididae]

3152 Cacoecia rosaceana (Harris) (Oblique-banded leafroller) [Lepidoptera: Olethreutidae]

3153 Bruchus major Fall [Coleoptera: Bruchidae]

3154 Meloe tinctus LeConte [Coleoptera: Meloidae]

3155 Tanarthrus salicola LeConte [Coleoptera: Anthicidae]

3156 Hyperaspis postica LeConte [Coleoptera: Coccinellidae]

3157 Amphorophora crystleae Smith & Knowlton [Homoptera: Aphididae] Immature/Adult Guild: Sap feeder/Sap feeder

3158 Neltumius gibbothorax [Homoptera: Aphididae]

3159 Neltumius arizonensis [Coleoptera: Bruchidae]

3160 Acmaeodera pulchella Herbst [Coleoptera: Buprestidae] Oviposition Medium: Bark surfaces

3161 Tischeria immaculata (Braun) [Lepidoptera: Tischeriidae] Immature/Adult Guild: Leaf miner/?

3162 Myzocallis discolor coloradensis [Homoptera: Aphididae]

3163 Euceraphis brevis [Homoptera: Aphididae]

3164 Aphis minutissima (G. & P.) [Homoptera: Aphididae]

3165 Macrosiphum laevigatae Essig [Homoptera: Aphididae]

3166 Corythucha contaminata Gibson [Hemiptera: Tingidae]

3167 Corythucha piercei Gibson [Hemiptera: Tingidae]

3168 Macrosiphum anomellus Knowlton & Allen [Homoptera: Aphididae] Immature/Adult Guild: Sap feeder/Sap feeder

3169 Macrosiphum artemisvulgaris Knowlton & Allen [Homoptera: Aphididae]

3170 Macrosiphum essigi (Soliman) [Homoptera: Aphididae]

3171 Macrosiphum zerothermus Knowlton & Allen [Homoptera: Aphididae]

3172 Macrosiphum chrysanthemi Oestlund [Homoptera: Aphididae]

3173 Macrosiphum escalantii (Knowlton) [Homoptera: Aphididae]

3174 Macrosiphum ambrosiae (Thomas) [Homoptera: Aphididae] Immature/Adult Guild: Sap feeder/Sap feeder

3175 Capitophorus decampus Knowlton & Smith [Homoptera: Aphididae]

3176 Capitophorus infrequenus Knowlton & Smith [Homoptera: Aphididae]

3177 Capitophorus spatulavillus Knowlton & Smith [Homoptera: Aphididae]

3178 Capitophorus acanthovillus Knowlton & Smith [Homoptera: Aphididae]

3179 Capitophorus chlorophainus Knowlton & Smith [Homoptera: Aphididae]

3180 Capitophorus utensus Pack & Knowlton [Homoptera: Aphididae]

3181 Kakimia muesebecki Knowlton & Allen [Homoptera: Aphididae]

3182 Kakimia ribifolii (Dvds.) [Homoptera: Aphididae]

3183 Kakimia houghtonensis (Troop) [Homoptera: Aphididae]

3184 Kakimia ceri Gillette & Palmer [Homoptera: Aphididae]

3185 Hippodamia ambigua LeConte [Coleoptera: Coccinellidae] Immature/Adult Guild: Predator/Predator

3186 Oedopa capito [Diptera: Agromyzidae]

3187 Ophomyia spp. [Diptera: Agromyzidae]

3188 Napomyza spp. [Diptera: Agromyzidae]

3189 Melanagromyza spp. [Diptera: Agromyzidae]

3190 Haplomyza togata [Diptera: Agromyzidae]

3191 Paraphytomyza spp. [Diptera: Agromyzidae]

3192 Deopalpus hirsutus Ths. [Diptera: Tachinidae]

3193 Chaetonodexodes vanderwulpi Ths. [Diptera: Tachinidae]

3194 Bonnetia comta Fallen [Diptera: Tachinidae]

3195 Aphantorhapha spp. [Diptera: Tachinidae]

3196 Metopotachis spp. [Diptera: Tachinidae]

3197 Gymnosoma fuliginosum R.D. [Diptera: Tachinidae]

3198 Gonia spp. [Diptera: Tachinidae]

3199 Eryciini spp. [Hymenoptera: Tachinidae]

3200 Periscepsia cinerosa (Coq.) [Diptera: Tachinidae]

3201 Periscepsia helymus (Walker) [Diptera: Tachinidae]

3202 Pararchytas decisus (Walker) [Diptera: Tachinidae]

3203 Paradidyma singularis (Ths.) [Diptera: Tachinidae]

3204 Nowickia latipacies Tuthill [Diptera: Tachinidae]

3205 Microchaetina nr. valida (Ths.) [Diptera: Tachinidae]

3206 Stomatomyia parvipalpi Will. (Wulp.) [Diptera: Tachinidae]

3207 Sitophaga nr. sordicolor (Ths.) [Diptera: Tachinidae]

3208 Reinhardiana petiolata (Townsend) [Diptera: Tachinidae]

3209 Psalidopteryx spp. [Diptera: Tachinidae]

3210 Pseudoperichaeta erecta (Coq.) [Diptera: Tachinidae]

3211 Promasiphya confusa (Ald.) [Diptera: Tachinidae]

3212 Promasiphya spp. [Diptera: Tachinidae]

3213 Calliphora coloradensis Hgh. [Diptera: Calliphoridae]

3214 Amobia floridensis (Townsend) [Diptera: Sarcophagidae]

3215 Blaesoxipha opifera (Aldrich) (Coquillett) [Diptera: Sarcophagidae]

3216 Opsidia oblata (Townsend) [Diptera: Sarcophagidae]

3217 Ptychoneura aristalis (Coq.) [Diptera: Sarcophagidae]

3218 Eumacronychia montana Allen [Diptera: Sarcophagidae]

3219 Miltogramminae spp. [Diptera: Sarcophagidae]

3220 Helina troene (Walker) [Diptera: Muscidae]

3221 Senotainia nr. trilineata (Wulp) [Diptera: Sarcophagidae]

3222 Taxigramma heteroneura (Mg.) [Diptera: Sarcophagidae]

3223 Senotainia flavicornis (Townsend) [Diptera: Sarcophagidae]

3224 Sarcophaga bishoppi Ald. [Diptera: Sarcophagidae]

3225 Sarcophaga bullata Parker [Diptera: Sarcophagidae]

3226 Leucophora spp. [Diptera: Sarcophagidae]

3227 Limosia spp. [Diptera: Sarcophagidae]

3228 Hylemya cinerella (Fallen) [Diptera: Sarcophagidae]

3229 Tetramerinx nr. unica (Stein) [Diptera: Sarcophagidae]

3230 Spilogona spp. [Diptera: Sarcophagidae]

3231 Spilogona argentiventris (Malloch) [Diptera: Sarcophagidae]

3232 Schoenomyza spp. [Diptera: Sarcophagidae]

3233 Pegomya spp. [Diptera: Sarcophagidae]

3234 Calythea micropteryx Thomas [Diptera: Muscidae]

3235 Haematobia irritans (Linnaeus) [Diptera: Muscidae]

3236 Acyrthosiphon purshiae Palmer [Homoptera: Aphididae]

3237 Zagogramini spp. [Hymenoptera: Eulophidae]

3238 Leucospis affinis Say [Hymenoptera: Leucospididae]

3239 Chrysophagus spp. [Hymenoptera: Encyrtidae]

3240 Cheiloneurus spp. [Hymenoptera: Encyrtidae]

3241 Chalcaspis spp. [Hymenoptera: Encyrtidae]

3242 Chrysopophagus spp. [Hymenoptera: Encyrtidae]

3243 Blastothrix spp. [Hymenoptera: Encyrtidae]

3244 Bothriothorax spp. [Hymenoptera: Encyrtidae]

3245 Apoanagris spp. [Hymenoptera: Encyrtidae]

3246 Erythrophagus spp. [Hymenoptera: Encyrtidae]

3247 Encyrtus spp. [Hymenoptera: Encyrtidae]

3248 Dicarnosis spp. [Hymenoptera: Encyrtidae]

3249 Discodes spp. [Hymenoptera: Encyrtidae]

3250 Homalotylus spp. [Hymenoptera: Encyrtidae]

3251 Oenocyrtus spp. [Hymenoptera: Encyrtidae]

3252 Larhopalis spp. [Hymenoptera: Encyrtidae]

3253 Litomastix spp. [Hymenoptera: Encyrtidae]

3254 Eupelminae spp. [Hymenoptera: Encyrtidae]

3255 Calosota metallica Gah. [Hymenoptera: Encyrtidae]

3256 Eupelmus alynii French [Hymenoptera: Encyrtidae]

3257 Trechnites spp. [Hymenoptera: Encyrtidae]

3258 Melanophyeus spp. [Hymenoptera: Encyrtidae]

3259 Mercetencyrtus spp. [Hymenoptera: Encyrtidae]

3260 Pachyneuron allograptae Ashmead [Hymenoptera: Pteromalidae]

3261 Rhizomalus spp. [Hymenoptera: Pteromalidae]

3262 Ceroplastes irregularis Cockerell (Irregular wax scale) [Homoptera: Coccidae]

3263 Coccophagus spp. [Hymenoptera: Encyrtidae]

3264 Rhodobaenus tredecimpunctatus Illiger [Coleoptera: Curculionidae]

3265 Dibrachys spp. [Hymenoptera: Pteromalidae]

3266 Cephalothrips hesperus Hood [Thysanoptera: Phlaeothripidae]

3267 Cryptothrips rectangularis Hood [Thysanoptera: Phlaeothripidae]

3268 Cryptothrips sordidatus Hood [Thysanoptera: Phlaeothripidae]

3269 Liothrips gaviotae (Moulton) [Thysanoptera: Phlaeothripidae]

3270 Liothrips xanthocerus Hood [Thysanoptera: Phlaeothripidae]

3271 Liothrips corni Moulton [Thysanoptera: Phlaeothripidae]

3272 Liothrips ilex (Moulton) [Thysanoptera: Phlaeothripidae]

3273 Liothrips dumosa (Moulton) [Thysanoptera: Phlaeothripidae]

3274 Liothrips lepidus Cott [Thysanoptera: Phlaeothripidae]

3275 Rhynchothrips invisus Cott [Thysanoptera: Phlaeothripidae]

3276 Poecilothrips albopictus Uzel [Thysanoptera: Phlaeothripidae]

3277 Priesneriella citricauda Hood [Thysanoptera: Phlaeothripidae]

3278 Rhopalothrips bicolor Hood [Thysanoptera: Phlaeothripidae]

3279 Bagnalliella desertae Hood [Thysanoptera: Phlaeothripidae]

3280 Bagnalliella yuccae (Hinds) [Thysanoptera: Phlaeothripidae]

3281 Bagnalliella mojave Hood
[Thysanoptera: Phlaeothripidae]

3282 Haplothrips distalis Hood
[Thysanoptera: Phlaeothripidae]

3283 Haplothrips niger (Osborn)
[Thysanoptera: Phlaeothripidae]

3284 Leptothrips heliomanes Hood
[Thysanoptera: Phlaeothripidae]

3285 Leptothrips larreae Hood
[Thysanoptera: Phlaeothripidae]

3286 Neoheegeria verbasci (Osborn)
[Thysanoptera: Phlaeothripidae]

3287 Neurothrips magnafemoralis (Hinds)
[Thysanoptera: Phlaeothripidae]

3288 Phlaeothrips nodicornis O.M. Reuter
[Thysanoptera: Phlaeothripidae]

3289 Phlaeothrips armiger P.R. Jones
[Thysanoptera: Phlaeothripidae]

3290 Phlaeothrips salicacearum (Hood)
[Thysanoptera: Phlaeothripidae]

3291 Phlaeothrips lissonotus (Hood)
[Thysanoptera: Phlaeothripidae]

3292 Phlaeothrips costano (Hood)
[Thysanoptera: Phlaeothripidae]

3293 Phlaeothrips coriaceus Haliday
[Thysanoptera: Phlaeothripidae]

3294 Megalothrips picticornis Hood
[Thysanoptera: Phlaeothripidae]

3295 Megathrips hesperus (Moulton)
[Thysanoptera: Phlaeothripidae]

3296 Oedaleothrips jacksoni Hood
[Thysanoptera: Phlaeothripidae]
Immature/Adult Guild: ?/Epidermal feeder

3297 Stephanothrips bradleyi Hood
[Thysanoptera: Urothripidae]

3298 Protolaccus spp. [Hymenoptera:
Pteromalidae]

3299 Coelopisthia spp. [Hymenoptera:
Pteromalidae]

3300 Hobbya spp. [Hymenoptera:
Pteromalidae]

3301 Chlorocistrus spp. [Hymenoptera:
Pteromalidae]

3302 Merisus spp. [Hymenoptera:
Pteromalidae]

3303 Dianlinopsis callichroma Crawford
[Hymenoptera: Eulophidae]

3304 Notanisomorpha spp. [Hymenoptera:
Eulophidae]

3305 Chrysocharini spp. [Hymenoptera:
Eulophidae]

3306 Chrysontomyia spp. [Hymenoptera:
Eulophidae]

3307 Astichus spp. [Hymenoptera:
Eulophidae]

3308 Diglyphus nautali Gordh.
[Hymenoptera: Eulophidae]

3309 Diglyphus spp. [Hymenoptera:
Eulophidae]

3310 Tetracneminae spp. [Hymenoptera:
Eulophidae]

3311 Closterocerus spp. [Hymenoptera:
Eulophidae]

3312 Neochrysocharis spp. [Hymenoptera:
Eulophidae]

3313 Cirrospilus spp. [Hymenoptera:
Eulophidae]

3314 Elachertus spp. [Hymenoptera:
Eulophidae]

3315 Hyssopus spp. [Hymenoptera:
Eulophidae]

3316 Megastigmus spp. [Hymenoptera:
Eurytomidae]

3317 Harmoleta spp. [Hymenoptera:
Eurytomidae]

3318 Torymus potamnius Grissel
[Hymenoptera: Torymidae]

3319 Torymus occidentalis Hub.
[Hymenoptera: Torymidae]

3320 Torymus solitarius Osten Sacken
[Hymenoptera: Torymidae]

3321 Torymus dasyneurae Hub.
[Hymenoptera: Torymidae]

3322 Torymus kinseyi Hub. [Hymenoptera:
Torymidae]

3323 Torymus denticulatus [Hymenoptera:
Torymidae]

3324 Torymus fagopyrum Osten Sacken
[Hymenoptera: Torymidae]

3325 Torymus atheatus Grissell
[Hymenoptera: Torymidae]

3326 Pseudotorymus spp. [Hymenoptera:
Torymidae]

3327 Microdontomerus spp. [Hymenoptera:
Torymidae]

3328 Torymus nr. aea Walker [Hymenoptera
Torymidae]

3329 Hybothoracicini spp. [Hymenoptera: Chalcididae]

3330 Brachymeria tegularis (Cresson) [Hymenoptera: Chalcididae]

3331 Schwarziella spp. [Hymenoptera: Chalcididae]

3332 Idris spp. [Hymenoptera: Scelionidae]

3333 Dissolcus spp. [Hymenoptera: Scelionidae]

3334 Gyron myrmecophilus Ashmead [Hymenoptera: Scelionidae]

3335 Gyron pennsylvanius Ashmead [Hymenoptera: Scelionidae]

3336 Scelio opacus Provancher [Hymenoptera: Scelionidae]

3337 Psilomma spp. [Hymenoptera: Proctotrupidae]

3338 Proctotrupes spp. [Hymenoptera: Proctotrupidae]

3339 Ceraphron spp. [Hymenoptera: Ceraphronidae]

3340 Idiocerus apache Ball & Parker [Homoptera: Cicadellidae]

3341 Platygaster rohweri Fouts [Hymenoptera: Platygasteridae]

3342 Aphanogmus spp. [Hymenoptera: Ceraphronidae]

3343 Diapria spp. [Hymenoptera: Diapriidae]

3344 Spilomicrus spp. [Hymenoptera: Diapriidae]

3345 Metaclisis spp. [Hymenoptera: Platygasteridae]

3346 Anacharis spp. [Hymenoptera: Eucoilidae]

3347 Gonaspidium spp. [Hymenoptera: Eucoilidae]

3348 Hypodiranchus spp. [Hymenoptera: Eucoilidae]

3349 Hexacola spp. [Hymenoptera: Eucoilidae]

3350 Kleidotoma spp. [Hymenoptera: Eucoilidae]

3351 Eucoila spp. [Hymenoptera: Eucoilidae]

3352 Neralcia spp. [Hymenoptera: Figitidae]

3353 Blacus spp. [Hymenoptera: Braconidae]

3354 Aphidius spp. [Hymenoptera: Braconidae]

3355 Bracon hyslopi (Viereck) [Hymenoptera: Braconidae]

3356 Bracon caulicola (Gahan) [Hymenoptera: Braconidae]

3357 Cantharoctonus spp. [Hymenoptera: Braconidae]

3358 Chelonus altitudinis Vier. [Hymenoptera: Braconidae]

3359 Cremnops californicus (Morrison) [Hymenoptera: Braconidae]

3360 Elasmosoma spp. [Hymenoptera: Braconidae]

3361 Gnaptodon nepticulae (Rah.)? [Hymenoptera: Braconidae]

3362 Leiophron spp. [Hymenoptera: Braconidae]

3363 Lysaphidius spp. [Hymenoptera: Braconidae]

3364 Meteorus leviventris (Wesw.) [Hymenoptera: Braconidae]

3365 Microplitis brassicae Mues. [Hymenoptera: Braconidae]

3366 Mirax spp. [Hymenoptera: Braconidae]

3367 Microctonus eleodes Vier. [Hymenoptera: Braconidae]

3368 Orgilus ferus Mues. [Hymenoptera: Braconidae]

3369 Parahormius pallidipes (Ashmead) [Hymenoptera: Braconidae]

3370 Trioxys spp. [Hymenoptera: Braconidae]

3371 Trioxys bonnevillensis Smith [Hymenoptera: Braconidae]

3372 Anomalon spp. [Hymenoptera: Ichneumonidae]

3373 Diadegma spp. [Hymenoptera: Ichneumonidae]

3374 Cryptus albitarsis Cresson [Hymenoptera: Ichneumonidae]

3375 Buathra laborator altonii (D.T.) [Hymenoptera: Ichneumonidae]

3376 Venturia spp. [Hymenoptera: Ichneumonidae]

3377 Temelucha spp. [Hymenoptera: Ichneumonidae]

3378 Pristomerus spp. [Hymenoptera: Ichneumonidae]

3379 Omalus spp. [Hymenoptera: Chrysididae]

3380 Hedychridium taylori (Bod.) [Hymenoptera: Chrysididae]

3381 Hedychridium violaceum Brulle [Hymenoptera: Chrysididae]

3382 Chrysis astralia [Hymenoptera: Chrysididae]

3383 Aphelopus spp. [Hymenoptera: Dryinidae]

3384 Epyris clarimontis Kieffer [Hymenoptera: Sapygidae]

3385 Epyris rufipes Say [Hymenoptera: Sapygidae]

3386 Epyris sculleni Say [Hymenoptera: Sapygidae]

3387 Sapyga pumila Coq. [Hymenoptera: Sapygidae]

3388 Anisopyris occidentalis Ashmead [Hymenoptera: Bethylidae]

3389 Ammophila varipes Cresson [Hymenoptera: Sphecidae]

3390 Ammophila azteca Cameron [Hymenoptera: Sphecidae]

3391 Ammophila cleopatra Menke [Hymenoptera: Sphecidae]

3392 Ammophila breviceps F. Smith [Hymenoptera: Sphecidae]

3393 Ammophila macra Cresson [Hymenoptera: Sphecidae]

3394 Ammophila unita Menke [Hymenoptera: Sphecidae]

3395 Ammophila dysmica Menke [Hymenoptera: Sphecidae]

3396 Ammophila aberti Hald. [Hymenoptera: Sphecidae]

3397 Astata bechteli Parker [Hymenoptera: Sphecidae]

3398 Bembix americanus comata Parker [Hymenoptera: Sphecidae]

3399 Bembix amoena Handlirsch [Hymenoptera: Sphecidae]

3400 Belomicrus spp. [Hymenoptera: Sphecidae]

3401 Bethynostethus spp. [Hymenoptera: Sphecidae]

3402 Bicyrtes capnoptera Handl. [Hymenoptera: Sphecidae]

3403 Cerceris echo Mickel [Hymenoptera: Sphecidae]

3404 Cerceris conifrons Mickel [Hymenoptera: Sphecidae]

3405 Cerceris californica Cresson [Hymenoptera: Sphecidae]

3406 Cerceris minax Mickel [Hymenoptera: Sphecidae]

3407 Chlorion aerarium Patton [Hymenoptera: Sphecidae]

3408 Dryudella spp. [Hymenoptera: Sphecidae]

3409 Dryudella immigrans Wm. [Hymenoptera: Sphecidae]

3410 Ectemnius besseyae (Roh.) [Hymenoptera: Sphecidae]

3411 Ectemnius continuus (F.) [Hymenoptera: Sphecidae]

3412 Ectemnius spp. [Hymenoptera: Sphecidae]

3413 Epinysson bellus (Cresson) [Hymenoptera: Sphecidae]

3414 Eucerceris vittatifrons Cresson [Hymenoptera: Sphecidae]

3415 Eucerceris canaliculata (Say) [Hymenoptera: Sphecidae]

3416 Fernaldina lucae (Sauss.) [Hymenoptera: Sphecidae]

3417 Gorytes provancheri Handl. [Hymenoptera: Sphecidae]

3418 Hoplisoides punctifrons (Cam.) [Hymenoptera: Sphecidae]

3419 Isodontia elegans Sm. [Hymenoptera: Sphecidae]

3420 Mimesa spp. [Hymenoptera: Sphecidae]

3421 Motes argentata [Hymenoptera: Sphecidae]

3422 Oxybelus packardii Robt. [Hymenoptera: Sphecidae]

3423 Oxybelus parvus Cresson [Hymenoptera: Sphecidae]

3424 Palmodes dimidintus DeGeer [Hymenoptera: Sphecidae]

3425 Philanthus gibbosus (F.) [Hymenoptera: Sphecidae]

3426 Chalicodoma subexilis Cockerell [Hymenoptera: Megachilidae]

3427 Coelioxys spp. [Hymenoptera: Megachilidae]

3428 Dianthidium ulkei Cresson [Hymenoptera: Megachilidae]

3429 Dianthidium pudicum decorum Timberlake [Hymenoptera: Megachilidae]

3430 Heriades varidosa Cresson [Hymenoptera: Megachilidae]

3431 Megachile augustini Cockerell [Hymenoptera: Megachilidae]

3432 Megachile pacifica [Hymenoptera: Megachilidae]

3433 Osmia lignaria Cresson [Hymenoptera: Megachilidae]

3434 Anthophora maculifrons Cresson [Hymenoptera: Megachilidae]

3435 Anthophora occidentalis Cresson [Hymenoptera: Megachilidae]

3436 Anthophora urbana Cresson [Hymenoptera: Megachilidae]

3437 Anthophora ursina Cresson [Hymenoptera: Megachilidae]

3438 Anthophora portera Cockerell [Hymenoptera: Megachilidae]

3439 Anthophora edwardsii Cresson [Hymenoptera: Megachilidae]

3440 Anthophora nr. edwardsii Cresson [Hymenoptera: Megachilidae]

3441 Ceratina nanula [Hymenoptera: Megachilidae]

3442 Epeolus spp. [Hymenoptera: Megachilidae]

3443 Melissodes utahensis LaB. [Hymenoptera: Megachilidae]

3444 Melissodes glenwoodensis Cockerell [Hymenoptera: Megachilidae]

3445 Melissodes bimatris LaB. [Hymenoptera: Megachilidae]

3446 Melissodes menuachis Cresson [Hymenoptera: Megachilidae]

3447 Melissodes subagilus Cockerell [Hymenoptera: Megachilidae]

3448 Melissodes agilis Cresson [Hymenoptera: Megachilidae]

3449 Neolarra spp. [Hymenoptera: Megachilidae]

3450 Nomada fragilis Cresson [Hymenoptera: Megachilidae]

3451 Triepeolus spp. [Hymenoptera: Megachilidae]

3452 Bombus morrisoni Cresson [Hymenoptera: Apidae]

3453 Melanoplus mexicanus Saussure [Orthoptera: Acrididae]

3454 Conozoa carinata Rehn. [Orthoptera: Acrididae]

3455 Trimerotropis spp. [Orthoptera: Acrididae]

3456 Trimerotropis bilobata Rehn. & Hess. [Orthoptera: Acrididae]

3457 Agulla spp. [Neuroptera: Raphididae]

3458 Micromus variolosus Hag. [Neuroptera: Hemerobiidae]

3459 Coniopterygidae spp. (Dusty-wings) [Neuroptera: Coniopterygidae]
Immature/Adult Guild: Predator/?

3460 Isoperla longiseta Bk. [Plecoptera: Perlodidae]

3461 Isogenoides colubrinus Hag. [Plecoptera: Perlodidae]

3462 Codophila remota Horn [Hemiptera: Pentatomidae]

3463 Holcostethus limbolarius (Stal) [Hemiptera: Pentatomidae]

3464 Cymus luridus Stal [Hemiptera: Lygaeidae]

3465 Emblethis vicarius Horn [Hemiptera: Lygaeidae]

3466 Kleidocerys resedae (Panz.) [Hemiptera: Lygaeidae]

3467 Corizus punctiventris Dallas [Hemiptera: Coreidae]

3468 Corizus spp. [Hemiptera: Coreidae]

3469 Stictopleurus viridicatus (Uhler) [Hemiptera: Coreidae]

3470 Ploiaria denticauda M. & M. [Hemiptera: Reduviidae]

3471 Piesma incisa McA. [Hemiptera: Piesmatidae]

3472 Phymata fasciata (Gray) [Hemiptera: Phymatidae]

3473 Physatocheila variegata Parshley [Hemiptera: Tingidae]

3474 Pilophorus spp. [Hemiptera: Miridae]

3475 Clivinema spp. [Hemiptera: Miridae]

3476 Lopidea media (Say) [Hemiptera: Miridae]

3477 Plagiognathus spp. [Hemiptera: Miridae]

3478 Dichroascytus spp. [Hemiptera: Miridae]

3479 Beckocoris laticephalus Knight [Hemiptera: Miridae]

3480 Chlamydatus associatus Uhler [Hemiptera: Miridae] Immature/Adult Guild: Flower,leaf feeder/Bud,flower,leaf feeder

3481 Chlamydatus spp. [Hemiptera: Miridae]

3482 Adelphocoris superbus (Uhler) [Hemiptera: Miridae]

3483 Orectoderus spp. [Hemiptera: Miridae]

3484 Hadrodema spp. [Hemiptera: Miridae]

3485 Stenedema virens Linnaeus [Hemiptera: Miridae]

3486 Lopidea spp. [Hemiptera: Miridae]

3487 Teleorhinus spp. [Hemiptera: Miridae]

3488 Melanotrichus albocostatus [Hemiptera: Miridae]

3489 Homoscellis spp. [Hemiptera: Miridae]

3490 Sympetrum obtrusum (Hagen) [Odonata: Libellulidae]

3491 Sympetrum spp. [Odonata: Libellulidae]

3492 Enallagma caruneulatum Morse [Odonata: Coenagrionidae]

3493 Agrilus nr. gibbicollis Fallen [Coleoptera: Buprestidae] Oviposition Medium: Bark surfaces

3494 Pieris protodice [Lepidoptera: Pieridae]

3495 Agapostemon femoratus Crawford [Hymenoptera: Halictidae]

3496 Halictus virgatellus Cockerell [Hymenoptera: Halictidae]

3497 Sphecodes spp. [Hymenoptera: Halictidae]

3498 Andrena nigrae R.H. [Hymenoptera: Andrenidae]

3499 Andrena ramaleyi Cockerell [Hymenoptera: Andrenidae]

3500 Andrena prunorum Cockerell [Hymenoptera: Andrenidae]

3501 Nomadopsis scitula Cresson [Hymenoptera: Andrenidae]

3502 Perdita stottleri Cockerell [Hymenoptera: Andrenidae]

3503 Perdita caloneura Cockerell [Hymenoptera: Andrenidae]

3504 Perdita cortifoliae Cockerell [Hymenoptera: Andrenidae]

3505 Perdita nuda Cockerell [Hymenoptera: Andrenidae]

3506 Perdita zebrata Cresson [Hymenoptera: Andrenidae]

3507 Colletes dissoptus Timberlake [Hymenoptera: Colletidae]

3508 Colletes simulans Cresson [Hymenoptera: Colletidae]

3509 Hylaeus stevensi Crawford [Hymenoptera: Colletidae]

3510 Hylaeus affinis F. Smith [Hymenoptera: Colletidae]

3511 Hylaeus cressoni (Cockerell) [Hymenoptera: Colletidae] Immature/Adult Guild: ?/Nectar,pollen feeder

3512 Hylaeus nr. calvus Metz [Hymenoptera: Colletidae]

3513 Dasymutilla vestita (Lep.) [Hymenoptera: Mutillidae]

3514 Ephuta spp. [Hymenoptera: Mutillidae]

3515 Clastoptera arborina Ball [Homoptera: Cercopidae]

3516 Campsoscolia alcione [Hymenoptera: Scoliidae]

3517 Ancistrocerus spp. [Hymenoptera: Vespidae]

3518 Ancistrocerus adiabatus (Say) (Saussure) [Hymenoptera: Vespidae]

3519 Euodynerus auranus (Cameron) [Hymenoptera: Eumenidae]

3520 Eumenus bollii Cresson [Hymenoptera: Eumenidae]

3521 Euodynerus exoglyphus albovittatus R. Bohart [Hymenoptera: Eumenidae]

3522 Euodynerus foraminalus blandinus (Roh.) [Hymenoptera: Eumenidae]

3523 Euodynerus spp. [Hymenoptera: Eumenidae]

3524 Microdynerus bakirianus Carn. [Hymenoptera: Vespidae]

3525 Parancistrocerus minimoferus R. Bohart [Hymenoptera: Vespidae]

3526 Pterocheilus quinquefasciatus Say [Hymenoptera: Vespidae]

3527 Pterocheilus spp. [Hymenoptera: Vespidae]

3528 Stenodynerus anormis (Say) [Hymenoptera: Vespidae]

3529 Stenodynerus apache R. Bohart [Hymenoptera: Vespidae]

3530 Pisonopsis spp. [Hymenoptera: Sphecidae]

3531 Plenoculus spp. [Hymenoptera: Sphecidae]

3532 Podalonia mexicana (Saussure) [Hymenoptera: Sphecidae]

3533 Podalonia sericea Murray [Hymenoptera: Sphecidae]

3534 Solierella spp. [Hymenoptera: Sphecidae]

3535 Steniolia elegans J. Parker [Hymenoptera: Sphecidae]

3536 Stictiella nubilosa Gillaspy [Hymenoptera: Sphecidae]

3537 Stictiella plana Fox [Hymenoptera: Sphecidae]

3538 Stizoides unicinctus Say [Hymenoptera: Sphecidae]

3539 Tachysphex alpestris Roh. [Hymenoptera: Sphecidae]

3540 Tachysphex tarsatus Say [Hymenoptera: Sphecidae]

3541 Tachysphex spp. [Hymenoptera: Sphecidae]

3542 Tachytes hesperus Bes. [Hymenoptera: Sphecidae]

3543 Tachytes distinctus Smith [Hymenoptera: Sphecidae]

3544 Tachytes nevadensis R. Bohart [Hymenoptera: Sphecidae]

3545 Tachytes ermineus Banks [Hymenoptera: Sphecidae]

3546 Zanysson texanus (Cresson) [Hymenoptera: Sphecidae]

3547 Ageniella euphorbiae Vier. [Hymenoptera: Pompilidae]

3548 Ageniella conflicta (Banks) [Hymenoptera: Pompilidae]

3549 Ageniella spp. [Hymenoptera: Pompilidae]

3550 Agenioideus biedermani (Banks) [Hymenoptera: Pompilidae]

3551 Anoplius insolens (Banks) [Hymenoptera: Pompilidae]

3552 Anoplius americanus ambiuguus (Dlb.) [Hymenoptera: Pompilidae]

3553 Anoplius relativus (Fox) [Hymenoptera: Pompilidae]

3554 Anoplius illinoensis [Hymenoptera: Pompilidae]

3555 Aporinellus fasciatus (Smith) [Hymenoptera: Pompilidae]

3556 Aporinellus yucatanensis (Cameron) [Hymenoptera: Pompilidae]

3557 Aporinellus medianus Banks [Hymenoptera: Pompilidae]

3558 Ceropales brevicornis Patton [Hymenoptera: Pompilidae]

3559 Evagetes padrinus padrinus (Vier.) [Hymenoptera: Pompilidae]

3560 Evagetes hyacinthinus (Cresson) [Hymenoptera: Pompilidae]

3561 Aporus luxus (Banks) [Hymenoptera: Pompilidae]

3562 Eusimulium spp. [Diptera: Simuliidae]

3563 Euxoriste occidentalis Coq. [Diptera: Sciaridae]

3564 Stragania rufoscutellata (Baker) [Homoptera: Cicadellidae]

3565 Bibio spp. [Diptera: Bibionidae]

3566 Apolysis spp. [Diptera: Bombyliidae]

3567 Poecilanthrax halycon Say [Diptera: Bombyliidae]

3568 Leptogaster spp. [Diptera: Bombyliidae]

3569 Holopogon spp. [Diptera: Asilidae]

3570 Chrysops discalis Will. [Diptera: Tabanidae]

3571 Scenopinus spp. [Diptera: Scenopinidae]

3572 Thryptieus spp. [Diptera: Empididae]

3573 Philophuga uteana Csy. [Coleoptera: Carabidae]

3574 Pseudoluperus longulus LeConte [Coleoptera: Chrysomelidae]

3575 Glyptoscelis spp. [Coleoptera: Chrysomelidae]

3576 Idiocerus amoenus Van Duzee [Homoptera: Cicadellidae]

3577 Ceutorhyncus adspersulus Dietz [Coleoptera: Curculionidae]

3578 Hippodamia tredecimpunctata Linnaeus [Coleoptera: Coccinellidae]

3579 Hyperaspidius vettigera Leconte [Coleoptera: Coccinellidae]

3580 Limonius spp. [Coleoptera: Elateridae]

3581 Cardiophorus spp. [Coleoptera: Elateridae]

3582 Chalarus spp. [Diptera: Pipunculidae]

3583 Zodion intermedium Bks. [Diptera: Pipunculidae]

3584 Chrysotoxum coloradense Gr. [Diptera: Syrphidae]

3585 Sphaerophoria spp. [Diptera: Syrphidae]

3586 Ocyptamus lemur (Osten Sacken) [Diptera: Syrphidae]

3587 Prorates claripennis Mel. [Diptera: Syrphidae]

3588 Allotricophora spp. [Diptera: Ephydridae]

3589 Chamaemyia varipes Coq. [Diptera: Chamaemyiidae]

3590 Calycomyza spp. [Diptera: Milichiidae]

3591 Melanagromyza nr. virescens Loew [Diptera: Agromyzidae]

3592 Eutreta pollinosa Curran [Diptera: Tephritidae]

3593 Neaspilota finalis (Linnaeus) [Diptera: Tephritidae]

3594 Stylia steyskali (Novak) [Diptera: Tephritidae]

3595 Hemiglyptus basalis (Crotch) (Rose flea beetle) [Coleoptera: Chrysomelidae]

3596 Trirhabda diducta Horn [Coleoptera: Chrysomelidae]

3597 Ophiomyia atriplicis Spencer & Hawkins [Diptera: Agromyzidae]

3598 Pnigalio flavipes Ashmead [Hymenoptera: Eulophidae]

3599 Periploca atrata Hodges [Lepidoptera: Gelechiidae]

3600 Epinotia kasloana McDunnough [Lepidoptera: Tortricidae] Immature/Adult Guild: Internal fruit feeder/?

3601 Platygaster pini Fouts [Hymenoptera: Platygasteridae] Immature/Adult Guild: Endoparasite/?

3602 Aphis schuhi Robinson [Homoptera: Aphididae]

3603 Aphis holodisci Robinson [Homoptera: Aphididae]

3604 Ulophora timberlakei Blanc. & Foote [Diptera: Tephritidae]

3605 Piophila spp. [Diptera: Piophilidae]

3606 Aphaniosoma spp. [Diptera: Chyromyidae]

3607 Aceratagallia arida Oman [Homoptera: Cicadellidae]

3608 Ceratagallia spp. [Homoptera: Cicadellidae]

3609 Macropsis spp. [Homoptera: Cicadellidae]

3610 Idiocerus snowi [Homoptera: Cicadellidae]

3611 Idiocerus nervatus Van Duzee [Homoptera: Cicadellidae]

3612 Idiocerus ramentosus (Uhler) [Homoptera: Cicadellidae]

3613 Idiocerus rotundens DeLong & Cald. [Homoptera: Cicadellidae]

3614 Gypona melanota (Spangb.) [Homoptera: Cicadellidae]

3615 Pachyopsis laetus Uhler [Homoptera: Cicadellidae]

3616 Graphocephala confluens (Uhler) [Homoptera: Cicadellidae]

3617 Empoasca eniguae Ross [Homoptera: Cicadellidae]

3618 Erythroneura aspersa [Homoptera: Cicadellidae]

3619 Acinopterus viridis Ball [Homoptera: Cicadellidae]

3620 Balclutha impicta (Van Duzee) [Homoptera: Cicadellidae]

3621 Balclutha punctata (Thunb.) [Homoptera: Cicadellidae]

3622 Macrosteles snowi [Homoptera: Cicadellidae]

3623 Colladonus belli (Uhler) [Homoptera: Cicadellidae]

3624 Twiningia blanda (Ball) [Homoptera: Cicadellidae]

3625 Aligia oculea (Ball) [Homoptera: Cicadellidae]

3626 Norvellina spp. [Homoptera: Cicadellidae]

3627 Aplanus albidus (Ball) [Homoptera: Cicadellidae]

3628 Aplanus pauperculus (Ball) [Homoptera: Cicadellidae]

3629 Scleroracus plutonius (Uhler) [Homoptera: Cicadellidae]

3630 Idiodonus spp. [Homoptera: Cicadellidae]

3631 Hebecephalus sagittatus [Homoptera: Cicadellidae]

3632 Laevicephalus exiguus Knull [Homoptera: Cicadellidae]

3633 Mormoria bisignata (Ball) [Homoptera: Cicadellidae]

3634 Sorhoanus debilis (Uhler) [Homoptera: Cicadellidae]

3635 Cabrulus labeculus (DeLong) [Homoptera: Cicadellidae]

3636 Leptoglossus occidentalis Heid. [Hemiptera: Coreidae]

3637 Rhynocoris ventralis (Say) [Hemiptera: Reduviidae]

3638 Nabis vanduzeei [Hemiptera: Nabidae]

3639 Capsus cinctus Kol. [Hemiptera: Miridae]

3640 Hadronema princeps Uhler [Hemiptera: Miridae]

3641 Rhagoletis zephyria Snow (Snowberry maggot) [Diptera: Tephritidae] Immature/Adult Guild: Fruit feeder/?

3642 Neolasioptera willistoni (Cockerell) [Diptera: Cecidomyiidae] Immature/Adult Guild: Gall former/?

3643 Lasioptera tibialis Felt [Diptera: Cecidomyiidae] Immature/Adult Guild: Gall former/?

3644 Lasioptera spp. [Diptera: Cecidomyiidae] Immature/Adult Guild: Gall former/?

3645 Asphondylia atriplicis Cockerell [Hymenoptera: Eulophidae]

3646 Platygaster californica (Ashmead) [Hymenoptera: Platygasteridae]

3647 Platygaster lampronota Fouts [Hymenoptera: Platygasteridae]

3648 Zatropis capitis Burks [Hymenoptera: Pteromalidae]

3649 Gonioctena americana (Schaeffer) [Coleoptera: Chrysomelidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

3650 Tripedia nova (Smith) [Lepidoptera: Noctuidae] Immature/Adult Guild: Defoliator,seed eater/?

3651 Trichoclea antica [Lepidoptera: Noctuidae]

3652 Multareis cornutus Goding [Homoptera: Membracidae]

3653 Centrodontus atlas Goding [Homoptera: Membracidae]

3654 Multareoides bifurcatus Cook [Homoptera: Membracidae]

3655 Euphydryas gilletti Barnes [Lepidoptera: Nymphalidae]

3656 Eupelmella spp. [Hymenoptera: Eupelmidae]

3657 Olycella subumbrella Dyar [Lepidoptera: Pyralidae]

3658 Tetrastichus cecidobroter Gordh & Hawkins [Hymenoptera: Eulophidae]

3659 Lopidea dakota Knight [Hemiptera: Miridae]

3660 Melanotrichus althaea Huss. [Hemiptera: Miridae]

3661 Arhyssus spp. [Hemiptera: Rhopalidae]

3662 Stictopleurus spp. [Hemiptera: Rhopalidae]

3663 Clastoptera juniperina Ball [Homoptera: Cercopidae]

3664 Clastoptera delicata Uhler [Homoptera: Cercopidae]

3665 Aphis spp. [Homoptera: Aphididae]

3666 Pseudoepameibaphis spp. [Homoptera: Aphididae]

3667 Aphalonema spp. [Homoptera: Issidae]

3668 Hysteroptera cornutatum (Melich) [Homoptera: Issidae]

3669 Thionia cornutatum Van Duzee [Homoptera: Issidae]

3670 Petrova albicapitana arizonensis (Heinrich) [Lepidoptera: Olethreutidae] Immature/Adult Guild: Wood borer/?

3671 Oeme costata LeConte [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3672 Pityogenes knechteli Swaine [Coleoptera: Scolytidae] Immature/Adult Guild: Bark beetle/Bark beetle

3673 Chrysobothris trinervia (Kirby) [Coleoptera: Buprestidae] Immature/Adult Guild: Wood borer/? Oviposition Medium: Bark surfaces

3674 Melanophila piniedulis Burke [Coleoptera: Buprestidae] Immature/Adult Guild: Wood borer/? Oviposition Medium: Bark surfaces

3675 Stephanophachys sobrinus (Paykull) [Coleoptera: Bostrichidae] Immature/Adult Guild: Wood borer/?

3676 Chrysomela crotchi Brown [Coleoptera: Chrysomelidae] Immature/Adult Guild: ?/Leaf feeder

3677 Acronicta lepusculina Guenee (Cottonwood dagger moth) [Lepidoptera: Noctuidae] Immature/Adult Guild: Leaf feeder/?

3678 Orthosia hibisci (Guenee) [Lepidoptera: Noctuidae] Immature/Adult Guild: Leaf feeder/?

3679 Anacampsis niveopulvella (Chambers) [Lepidoptera: Gelechiidae] Immature/Adult Guild: Leaf feeder/?

3680 Choristoneura conflictana (Walker) (Large aspen tortrix) [Lepidoptera: Tortricidae] Immature/Adult Guild: Defoliator,leafroller/?

3681 Epinotia criddleana (Kearfott) [Lepidoptera: Olethreutidae] Immature/Adult Guild: Leafroller/? Oviposition Medium: Twig surfaces

3682 Pandemis canadana Kearfott [Lepidoptera: Tortricidae] Immature/Adult Guild: Leafroller/?

3683 Pseudexentera oregonana (Walsingham) [Lepidoptera: Olethreutidae] Immature/Adult Guild: Leafroller/? Overwintering Stage: Pupae Generations Per Year: 1

3684 Alsophila pometaria (Harris) [Lepidoptera: Geometridae] Immature/Adult Guild: Skeletonizer/? Oviposition Medium: Twig,branch surfaces

3685 Biston cognataria (Guenee) (Pepper-and-salt moth) [Lepidoptera: Geometridae] Immature/Adult Guild: Leaf feeder/?

3686 Erannis vancouverensis Hulst [Lepidoptera: Geometridae] Immature/Adult Guild: Leaf feeder/?

3687 Itame loricaria (Eversmann) [Lepidoptera: Geometridae] Immature/Adult Guild: Leaf feeder/?

3688 Operophtera bruceata (Hulst) (Bruce spanworm) [Lepidoptera: Geometridae] Immature/Adult Guild: Leaf feeder/? Overwintering Stage: Eggs Oviposition Medium: Bark crevices

3689 Lithocolletis tremuloidiella Braun (Aspen blotchminer) [Lepidoptera: Gracilariidae] Immature/Adult Guild: Leaf miner/?

3690 Phyllocnistis populiella Chambers (Aspen leafminer) [Lepidoptera: Gracilariidae] Immature/Adult Guild: Leaf miner/? Overwintering Stage: Adults Generations Per Year: 1

3691 Procryphalus mucronatus (LeConte) [Coleoptera: Scolytidae] Immature/Adult Guild: Bark beetle/Bark beetle

3692 Trypophloeus populi (Hopkins) [Coleoptera: Scolytidae] Immature/Adult Guild: Bark beetle/Bark beetle

3693 Trypophloeus thatcheri Wood [Coleoptera: Scolytidae] Immature/Adult Guild: Bark beetle/Bark beetle

3694 Laspeyresia populana Busck [Lepidoptera: Olethreutidae]

3695 Trypodendron retusum (LeConte) [Coleoptera: Scolytidae] Immature/Adult Guild: Bark beetle/Bark beetle

3696 Saperda calcarata Say (Poplar borer) [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer: live wood/? Overwintering Stage: Pupae Oviposition Medium: Bark surfaces Generations Per Year: 1/2

3697 Sthenopis quadriguttatus Grote (Ghost moth) [Lepidoptera: Hepialidae] Immature/Adult Guild: Root borer/?

3698 Desertana spp. [Homoptera: Dictyopharidae]

3699 Avidia compressus [Homoptera: Dictyopharidae]

3700 Andricus stellulus Burnett [Hymenoptera: Cynipidae] Immature/Adult Guild: Gall former/?

3701 Aciurina bigeloviae (Cockerell) [Diptera: Tephritidae] Immature/Adult Guild: Gall former/?

3702 Aciurina maculata (Cole) [Diptera: Tephritidae] Immature/Adult Guild: Gall former/?

3703 Crematogaster opuntiae Buren [Hymenoptera: Formicidae]

3704 Pogonomyrmex desertorum [Hymenoptera: Formicidae]

3705 Acanthoscelides submuticus (Sharp) [Coleoptera: Bruchidae] Immature/Adult Guild: Internal seed feeder/?

3706 Sennius celatus (Sharp) [Coleoptera: Bruchidae] Immature/Adult Guild: Internal seed feeder/?

3707 Chionanthobius autumnalis Clark [Coleoptera: Curculionidae] Immature/Adult Guild: Internal seed feeder/?

3708 Lepturges vogti Hovore [Coleoptera: Cerambycidae] Immature/Adult Guild: Leaf miner/?

3709 Lepturges yucca [Coleoptera: Cerambycidae]

3710 Synhalonia amoena Zavortink [Hymenoptera: Anthophoridae]

3711 Synhalonia venusta [Hymenoptera: Anthophoridae]

3712 Caliroa aethiops Fabricius (European rose slug) [Hymenoptera: Tenthredinidae] Immature/Adult Guild: Skeletonizer/? Overwintering Stage: Pupae Generations Per Year: 1

3713 Philolithus densicollis (Horn) [Coleoptera: Tenebrionidae]

3714 Chionanthobius spp. [Coleoptera: Curculionidae]

3715 Cradytes serricollis (LeConte) [Coleoptera: Melyridae] Immature/Adult Guild: ?/Nectar,pollen feeder

3716 Colletes phaceliae Cockerell [Hymenoptera: Colletidae] Immature/Adult Guild: ?/Nectar,pollen feeder

3717 Euxoa siccata (Smith) [Lepidoptera: Noctuidae] Immature/Adult Guild: ?/Nectar,pollen feeder

3718 Schinia unimacula Smith [Lepidoptera: Noctuidae] Immature/Adult Guild: ?/Nectar,pollen feeder

3719 Crambus vulgivagellus Clemens [Lepidoptera: Olethreutidae] Immature/Adult Guild: ?/Nectar,pollen feeder

3720 Epilachna varivestris Mulsant [Coleoptera: Chrysomelidae] Immature/Adult Guild: ?/Petal feeder

3721 Urophora timberlakei Blanc & Foote [Diptera: Tephritidae] Immature/Adult Guild: Internal seed feeder/?

3722 Calythea monticola Bigot [Diptera: Anthomyiidae] Immature/Adult Guild: ?/Nectar,pollen feeder

3723 Bombus spp. [Hymenoptera: Apidae] Immature/Adult Guild: ?/Nectar,pollen feeder

3724 Cremnops vulgaris (Cresson) [Hymenoptera: Braconidae] Immature/Adult Guild: ?/Nectar,pollen feeder

3725 Trielis spp. [Hymenoptera: Scoliidae] Immature/Adult Guild: ?/Nectar,pollen feeder

3726 Neotiphia spp. [Hymenoptera: Tiphiidae] Immature/Adult Guild: ?/Nectar,pollen feeder

3727 Diabrotica virgifera LeConte [Coleoptera: Chrysomelidae] Immature/Adult Guild: ?/Pollen feeder

3728 Amara idahoana Casey [Coleoptera: Carabidae] Immature/Adult Guild: ?/Seed feeder

3729 Osmia integra [Hymenoptera: Megachilidae] Immature/Adult Guild: ?/Leafcutter bee

3730 Lopidea confluenta (Say) [Hemiptera: Miridae] Immature/Adult Guild: ?/Sap feeder

3731 Tegeticula yuccasella (Riley) [Lepidoptera: Incurvariidae] Immature/Adult Guild: ?/Nectar,pollen feeder

3732 Diadasia spp. [Hymenoptera: Anthophoridae] Immature/Adult Guild: ?/Nectar,pollen feeder

3733 Chirothrips spp. [Thysanoptera: Thripidae]

3734 Craspedolepta artemisiae Forester [Homoptera: Psyllidae]

3735 Crophius disconotus [Hemiptera: Lygaeidae]

3736 Phyllobaenus subfasciatus (LeConte) [Coleoptera: Cleridae]

3737 Epimechus gracilis Fall [Coleoptera: Curculionidae]

3738 Macrorhoptrus hispidus Dietz [Coleoptera: Curculionidae]

3739 Platypedia putnami lutea Davis [Homoptera: Cicadidae]

3740 Okanagana rimosa Say [Homoptera: Cicadidae]

3741 Tibicen spp. [Homoptera: Cicadidae]

3742 Schistocerca emarginata [Orthoptera: Acrididae] Immature/Adult Guild: Leaf feeder/Leaf feeder

3743 Schistocerca americana [Orthoptera: Acrididae] Immature/Adult Guild: Leaf feeder/Leaf feeder

3744 Eurytoma compressa Bugbee [Hymenoptera: Eurytomidae] Immature/Adult Guild: Internal seed feeder/?

3745 Eurytoma scabriterga Bugbee [Hymenoptera: Eurytomidae]

3746 Euphydryas chalcedona Doubleday (Checkerspot or chalcedon) [Lepidoptera: Nymphalidae] Overwintering Stage: Larvae in webs Generations Per Year: Several

3747 Megacheuma brevipennis tiemanni Hovore [Coleoptera: Cerambycidae] Immature/Adult Guild: Root,stem borer/? Oviposition Medium: Soil,plant crowns

3748 Serica spp. [Coleoptera: Scarabaeidae]

3749 Dichelonyx spp. [Coleoptera: Scarabaeidae]

3750 Ctenicera pruinina [Coleoptera: Elateridae]

3751 Dalopius spp. [Coleoptera: Elateridae]

3752 Dyslobus simplex [Coleoptera: Curculionidae]

3753 Hesperumia sulphuraria Packard [Lepidoptera: Geometridae]

3754 Tetanops myopaeformis (Roder) (Sugarbeet root maggot) [Diptera: Otitidae] Immature/Adult Guild: Root feeder/?

3755 Asidopsis opaca (Say) [Coleoptera: Tenebrionidae]

3756 Asidopsis polita (Say) [Coleoptera: Tenebrionidae]

3757 Gonosida elata (LeConte) [Coleoptera: Tenebrionidae]

3758 Eleodes nigrinis LeConte [Coleoptera: Tenebrionidae]

3759 Eleodes obscurus (Say) [Coleoptera: Tenebrionidae]

3760 Eleodes sponsus LeConte [Coleoptera: Tenebrionidae]

3761 Eleodes tricostatus (Say) [Coleoptera: Tenebrionidae]

3762 Embaphion contractum LeConte [Coleoptera: Tenebrionidae]

3763 Embaphion contusum LeConte [Coleoptera: Tenebrionidae]

3764 Leptura pacifica (Linsley) [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/? Generations Per Year: 1/3

3765 Purpuricenus dimidiatus LeConte [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3766 Vespamima spp. [Lepidoptera: Sesiidae]

3767 Petrova spp. [Lepidoptera: Olethreutidae]

3768 Phyllotrox canyonaceris Warner [Coleoptera: Curculionidae] Immature/Adult Guild: Internal seed feeder/? Overwintering Stage: Larvae Oviposition Medium: Seed surfaces

3769 Incisitermes fruticavus Rust [Isoptera: Kalotermitidae] Immature/Adult Guild: Stem borer/Stem borer

3770 Hippomelas spp. [Coleoptera: Buprestidae] Immature/Adult Guild: Stem borer/? Oviposition Medium: Bark surfaces

3771 Metaponium convexicolle (LeConte) [Coleoptera: Tenebrionidae] Immature/Adult Guild: Stem borer/?

3772 Eleodes nigrina [Coleoptera: Tenebrionidae]

3773 Eleodes humeralis [Coleoptera: Tenebrionidae]

3774 Eleodes novoverrucula [Coleoptera: Tenebrionidae]

3775 Coniontis ovalis [Coleoptera: Tenebrionidae]

3776 Gloveria medusa editha Johnson [Lepidoptera: Lasiocampidae] Immature/Adult Guild: Leaf feeder/?

3777 Anambodera lucksani Walters [Coleoptera: Buprestidae] Oviposition Medium: Bark surfaces

3778 Diplolepis ashmeadi (Beutenmueller) [Hymenoptera: Cynipidae] Immature/Adult Guild: Gall former/?

3779 Diplolepis inconspicuis Dailey & Campbell [Hymenoptera: Cynipidae] Immature/Adult Guild: Gall former/?

3780 Parandra marginicollis marginicollis Schaeffer [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3781 Prionus lecontei Lameere [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3782 Ergates pauper Linsley [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3783 Tragosoma depsarius (Linnaeus) [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3784 Xylosteus ornatus LeConte [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3785 Pyrotrichus vitticollis LeConte [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer: injured wood/?

3786 Cortodera stolida (Casey) [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3787 Orthochoriolaus chihuahuae (Bates) [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3788 Eudistenia costipennis Fall [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3789 Paranoplium gracile gracile (LeConte) [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3790 Eburia falli Linsley [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3791 Eburia ovicollis LeConte [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3792 Hesperanoplium antennatum (Linsley) [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3793 Gnaphalodes trachyderoides Thompson [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3794 Osmidus guttatus LeConte [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3795 Knulliana cincta cincta (Drury) [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3796 Tragidion coquus (Linnaeus) [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3797 Tragidion peninsulare californicum Linsley [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3798 Tragidion gracilipes Linsley [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3799 Crossidius humeralis quadrivittatus Penrose [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3800 Crossidius militaris Bates [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3801 Deltaspis cruentus (LeConte) [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3802 Chrotoma dunniana Casey [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3803 Dendrobias mandibularis mandibularis Audinet & Serville [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3804 Stenosphenus texanus Knull [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3805 Eustromula validum (Horn) [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3806 Anelaphus inflaticollis Chemsak [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3807 Anelaphus debilis (LeConte) [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3808 Poecilobrium chalybeum (LeConte) [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3809 Molorchus bimaculatus californicus Linsley [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3810 Phymatodes decussatus decussatus (LeConte) [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3811 Placosternus erythropus (Chevrolat) [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3812 Tanyochraethes tildeni Chemsak & Linsley [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3813 Triodoclytus lanifer (LeConte) [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3814 Rhopalophora angustata Schaeffer [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3815 Rhopalophora prorubra Knull [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3816 Rhopalophora bicolorella Knull [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3817 Lochmaoecles marmoratus Casey [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3818 Tigrinestola tigrina (Skinner) [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3819 Enaphalodes seminitidus (Horn) [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3820 Aneflus paracalvatus Knull [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

3821 Pronuba yuccasella Riley [Lepidoptera: Incurvariidae]

3822 Tegeticula maculata (Riley) [Lepidoptera: Incurvariidae] Immature/Adult Guild: Seed pod feeder/Nectar,pollen feeder Oviposition Medium: Flowers,seed pods

3823 Prodoxus aenescens Riley [Lepidoptera: Incurvariidae] Immature/Adult Guild: Stem borer/?

3824 Pronuba cinereus Riley [Lepidoptera: Incurvariidae] Immature/Adult Guild: Stem borer/?

3825 Pronuba marginatus Riley [Lepidoptera: Incurvariidae] Immature/Adult Guild: Seed pod feeder/?

3826 Tegeticula synthetica (Riley) [Lepidoptera: Incurvariidae] Immature/Adult Guild: ?/Nectar,pollen feeder

3827 Prodoxus sordidus Riley [Lepidoptera: Incurvariidae] Immature/Adult Guild: Seed pod feeder/?

3828 Prodoxus spp. [Lepidoptera: Incurvariidae]

3829 Prodoxus coloradensis [Lepidoptera: Incurvariidae] Immature/Adult Guild: Stem borer/?

3830 Parategeticula pollenifera Davis [Lepidoptera: Incurvariidae] Immature/Adult Guild: ?/Nectar,pollen feeder

3831 Prodoxus ochrocarus Davis [Lepidoptera: Incurvariidae] Immature/Adult Guild: Stem borer/?

3832 Prodoxus y-inversus Riley [Lepidoptera: Incurvariidae] Immature/Adult Guild: Seed pod feeder/?

3833 Heterospilus koebelei (Ashmead) [Hymenoptera: Braconidae] Immature/Adult Guild: Ectoparasite/? Generations Per Year: Several

3834 Eusandalum spp. [Hymenoptera: Eupelmidae]

3835 Eudecatoma flamminneiventris (Girault) [Hymenoptera: Eupelmidae] Immature/Adult Guild: Endoparasite/? Generations Per Year: 1

3836 Telenomus clisiocampae Riley [Hymenoptera: Scelionidae] Immature/Adult Guild: Egg parasite/?

3837 Tetrastichus silvaticus Gahan [Hymenoptera: Eulophidae] Immature/Adult Guild: Egg parasite/?

3838 Ooencyrtus clisiocampae (Ashmead) [Hymenoptera: Encyrtidae] Immature/Adult Guild: Egg parasite/?

3839 Microrhopala rubrolineata rubrolineata (Mannerheim) [Coleoptera: Chrysomelidae]

3840 Microrhopala rubrolineata signaticollis LeConte [Coleoptera: Chrysomelidae]

3841 Microrhopala rubrolineata militaris Van Dyke [Coleoptera: Chrysomelidae]

3842 Rhopalomyia subhumilis Gagne [Diptera: Cecidomyiidae]

3843 Chrysolina flavomarginata (Say) [Coleoptera: Chrysomelidae]

3844 Tetrastichus cecidophagus Wangberg [Hymenoptera: Eulophidae]

3845 Tachypterellus quadrigibbus Say [Coleoptera: Curculionidae] Immature/Adult Guild: Fruit feeder/Fruit feeder

3846 Acmaeodera lanata Horn [Coleoptera: Buprestidae] Oviposition Medium: Bark surfaces

3847 Bembidion spp. [Coleoptera: Carabidae]

3848 Calosoma triste LeConte [Coleoptera: Carabidae]

3849 Calosoma spp. [Coleoptera: Carabidae]

3850 Harpalus corpulentus (Csy.) [Coleoptera: Carabidae]

3851 Harpalus furtivus (LeConte) [Coleoptera: Carabidae]

3852 Rhadine jejuna LeConte [Coleoptera: Carabidae]

3853 Rhadine spp. [Coleoptera: Carabidae]

3854 Selenophorus aeneopiceus Csy. [Coleoptera: Carabidae]

3855 Moneilema obtusa LeConte [Coleoptera: Cerambycidae]

3856 Prionus spp. [Coleoptera: Cerambycidae]

3857 Disonycha fumata (LeConte) [Coleoptera: Chrysomelidae]

3858 Cymatodera fuchsi Schaffer [Coleoptera: Cleridae]

3859 Cimbocera buchanani Ting. [Coleoptera: Curculionidae]

3860 Cimbocera conspersa Fall [Coleoptera: Curculionidae]

3861 Cimbocera petersoni Tanner [Coleoptera: Curculionidae]

3862 Dinocleus angularis (LeConte) [Coleoptera: Curculionidae]

3863 Eucyllus unicolor Van Dyke [Coleoptera: Curculionidae]

3864 Eupagoderes varius (LeConte) [Coleoptera: Curculionidae]

3865 Ophryastes sordidus LeConte [Coleoptera: Curculionidae]

3866 Saprinus lugens Et. [Coleoptera: Histeridae]

3867 Pyrota mulabrina Cher. [Coleoptera: Meloidae]

3868 Collops femoratus (Schaeffer) [Coleoptera: Melyridae]

3869 Ptinus spp. [Coleoptera: Ptinidae]

3870 Conotus lanchesteri Van Dyke [Coleoptera: Salpingidae]

3871 Aphodius rubidus (LeConte) [Coleoptera: Scarabaeidae]

3872 Polyphylla decemlineata (Csy.) [Coleoptera: Scarabaeidae]

3873 Araeoschizus dicipiens (Horn) [Coleoptera: Tenebrionidae]

3874 Chilometopon abnorme Horn [Coleoptera: Tenebrionidae]

3875 Coniontis opacus Horn [Coleoptera: Tenebrionidae]

3876 Coniontis spp. Doyen [Coleoptera: Tenebrionidae]

3877 Edrotes leechi Doyen [Coleoptera: Tenebrionidae]

3878 Eleodes caudifera LeConte [Coleoptera: Tenebrionidae]

3879 Eleodes hispilabris sculptilis Blais. [Coleoptera: Tenebrionidae]

3880 Eleodes immunis interstitralis Blais. [Coleoptera: Tenebrionidae]

3881 Eleodes leechi Tanner [Coleoptera: Tenebrionidae]

3882 Eleodes omissa pygmaea Blais. [Coleoptera: Tenebrionidae]

3883 Eleodes porcata Csy. [Coleoptera: Tenebrionidae]

3884 Exchatomoxys tanneri Sorenson & Stones [Coleoptera: Tenebrionidae]

3885 Glyptasida spp. (LeConte) [Coleoptera: Tenebrionidae]

3886 Hylocrinus delicatulus Csy. [Coleoptera: Tenebrionidae]

3887 Metaponium spp. [Coleoptera: Tenebrionidae]

3888 Pelecyphorus haruspex Csy. [Coleoptera: Tenebrionidae]

3889 Sphaeriontis muricata LeConte [Coleoptera: Tenebrionidae]

3890 Triorophus lariversi Blais. [Coleoptera: Tenebrionidae]

3891 Triorophus tenebratulus Csy. [Coleoptera: Tenebrionidae]

3892 Trogloderus tuberculatus Blais. [Coleoptera: Tenebrionidae]

3893 Schistocerca alutacea shoshone (Thomas) [Orthoptera: Acrididae] Immature/Adult Guild: Leaf feeder/Leaf feeder

3894 Dactuliothrips spinosus Moulton [Thysanoptera: Aeolothripidae] Immature/Adult Guild: Flower feeder/Flower feeder

3895 Scirtothrips ewarti Bailey [Thysanoptera: Thripidae] Immature/Adult Guild: Flower feeder/Flower feeder

3896 Amitermes minimus Light [Isoptera: Termitidae] Immature/Adult Guild: Stem borer/Stem borer

3897 Crophius spp. [Hemiptera: Lygaeidae]

3898 Irbisia setosa (Van Duzee) [Hemiptera: Miridae]

3899 Homalodisca lacerta (Fowler) [Homoptera: Cicadellidae]

3900 Dictyssa marginepunctata (Melich.) [Homoptera: Issidae]

3901 Dictyssa fenestrata Ball [Homoptera: Issidae]

3902 Aspidiotus nerii Bouche [Homoptera: Diaspididae] Immature/Adult Guild: Leaf feeder/Leaf feeder

3903 Disaspis simmondsiae Ferris [Homoptera: Diaspididae] Immature/Adult Guild: Leaf feeder/Leaf feeder

3904 Situlaspis yuccae (Cockerell) [Homoptera: Diaspididae] Immature/Adult Guild: Leaf feeder/Leaf feeder

3905 Phenacoccus alleni McKenzie [Homoptera: Pseudococcidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

3906 Phenacoccus solenopsis Tinsley [Homoptera: Pseudococcidae] Immature/Adult Guild: Leaf,stem feeder/Leaf,stem feeder

3907 Puto simmondsiae McKenzie [Homoptera: Pseudococcidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

3908 Spilococcus pressus Ferris [Homoptera: Pseudococcidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

3909 Megorama frontalis (LeConte) [Coleoptera: Anobiidae]

3910 Tricorynus obsoletus (LeConte) [Coleoptera: Anobiidae] Immature/Adult Guild: Seed feeder/Seed feeder

3911 Amphicerus simplex (Horn) [Coleoptera: Bostrichidae] Immature/Adult Guild: Stem borer/Stem borer

3912 Acmaeodera doloroa Fall [Coleoptera: Buprestidae] Immature/Adult Guild: Stem borer/? Oviposition Medium: Bark surfaces

3913 Chrysobothris lucana Horn [Coleoptera: Buprestidae] Immature/Adult Guild: Stem borer/? Oviposition Medium: Bark surfaces

3914 Trichinorhipis knulli Barr [Coleoptera: Buprestidae] Immature/Adult Guild: Stem borer/? Oviposition Medium: Bark surfaces

3915 Pseudomethia arida Linsley [Coleoptera: Cerambycidae] Immature/Adult Guild: Stem borer/?

3916 Anacamptodes sanctissima (B. & McD.) [Lepidoptera: Geometridae] Immature/Adult Guild: Leaf feeder/Leaf feeder

3917 Holocera spp. [Lepidoptera: Blastobasidae] Immature/Adult Guild: Decayed fruit feeder/?

3918 Anacamptodes clivinaria impia Rindge [Lepidoptera: Geometridae] Immature/Adult Guild: Leaf feeder/?

3919 Pero mcdunnoughi C. & S. [Lepidoptera: Geometridae] Immature/Adult Guild: Leaf feeder/?

3920 Synaxis hirsutaria B. & McD. [Lepidoptera: Geometridae] Immature/Adult Guild: Leaf feeder/?

3921 Xylomyges curialis Grote [Lepidoptera: Noctuidae] Immature/Adult Guild: Leaf feeder/?

3922 Sosipatra thurberiae (Dyar) [Lepidoptera: Pyralidae] Immature/Adult Guild: Decayed fruit feeder/?

3923 Hemileuca electra Wright [Lepidoptera: Saturniidae] Immature/Adult Guild: Leaf feeder/?

3924 Periploca spp. [Lepidoptera: Walshiidae] Immature/Adult Guild: Leaf miner/?

3925 Orgyia vetusta (Boisduvall) [Lepidoptera: Lymantriidae] Immature/Adult Guild: Leaf feeder/?

3926 Aeoloplides turnbulli turnbulli (Thomas) [Orthoptera: Acrididae]

Immature/Adult Guild: Leaf feeder/Leaf feeder

3927 Arphia spp. [Orthoptera: Acrididae]

3928 Boopedon nubilum (Say) [Orthoptera: Acrididae]

3929 Dactylotum bicolor pictum (Thomas) [Orthoptera: Acrididae]

3930 Hippiscus rugosus (Scudder) [Orthoptera: Acrididae]

3931 Melanoplus borealis junius (Dodge) [Orthoptera: Acrididae]

3932 Melanoplus dawsoni (Scudder) [Orthoptera: Acrididae]

3933 Melanoplus femurrubrum femurrubrum (DeGeer) [Orthoptera: Acrididae]

3934 Melanoplus flavidus (Scudder) [Orthoptera: Acrididae]

3935 Melanoplus keeleri (Thomas) [Orthoptera: Acrididae]

3936 Melanoplus scudderi scudderi (Uhler) [Orthoptera: Acrididae]

3937 Orphulella speciosa (Scudder) [Orthoptera: Acrididae]

3938 Pardalophora haldemanii (Scudder) [Orthoptera: Acrididae]

3939 Phoetaliotes nebrascensis (Thomas) [Orthoptera: Acrididae]

3940 Spharagemon spp. [Orthoptera: Acrididae]

3941 Melanoplus bowditchi canus (Hebard) [Orthoptera: Acrididae]

3942 Ageneotettix deorum deorum (Scudder) [Orthoptera: Acrididae]

3943 Chorthippus longicornis (Latreille) [Orthoptera: Acrididae]

3944 Cordillacris occipitalis cinerea (Bruner) [Orthoptera: Acrididae]

3945 Hesperotettix viridis pratensis (Scudder) [Orthoptera: Acrididae]

3946 Melanoplus flavidus flavidus (Scudder) [Orthoptera: Acrididae]

3947 Melanoplus keeleri luridus (Dodge) [Orthoptera: Acrididae]

3948 Melanoplus borealis (Fieber) [Orthoptera: Acrididae]

3949 Termes flavipes Kollar [Isoptera: Family?] Immature/Adult Guild: Dead stem borer/Dead stem borer

3950 Liotropis contaminatus Uhler [Hemiptera: Family?] Immature/Adult Guild: Fruit feeder/Fruit feeder

3951 Chelinidea spp. Burmeister [Hemiptera: Coreidae]

3952 Largus succinctus Linnaeus [Hemiptera: Largidae]

3953 Lopidea cuneata Van Duzee [Hemiptera: Miridae]

3954 Ocerometopus nigriclavus Reuter [Hemiptera: Family?]

3955 Hadronema robusta Uhler [Hemiptera: Miridae]

3956 Stylopidea picta Uhler [Hemiptera: Family?]

3957 Sixeonotus luteiceps Reuter [Hemiptera: Miridae]

3958 Macrotylus verticalis Uhler [Hemiptera: Miridae]

3959 Corythucha decens Stal [Hemiptera: Tingidae]

3960 Proarna valvata Uhler [Homoptera: Cicadidae]

3961 Narnia femorata Stal [Hemiptera: Coreidae] Immature/Adult Guild: Fruit feeder/Fruit feeder

3962 Dendrocoris contaminatus Uhler [Hemiptera: Pentatomidae]

3963 Narnia pallidicornis Stal [Hemiptera: Coreidae]

3964 Narnia snowi Van Duzee [Hemiptera: Coreidae]

3965 Platymetopius fuseifrons Van Duzee [Homoptera: Cicadellidae]

3966 Dictyobia permutata Uhler [Homoptera: Issidae]

3967 Margarodes spp. [Homoptera: Margarodidae]

3968 Eriococcus coccineus Cockerell [Homoptera: Eriococcidae]

3969 Dactylopius confusus Cockerell (Cottony cochineal scale) [Homoptera: Dactylopiidae]

3970 Dactylopius tomentosus Lamarck (Cottony cochineal scale) [Homoptera: Dactylopiidae]

3971 Pseudococcus virgatus Cockerell [Homoptera: Pseudococcidae]

3972 Myzus ribis Linnaeus (Currant aphid) [Homoptera: Aphididae]

Overwintering Stage: Eggs Oviposition Medium: Bark surfaces

3973 Ripersia spp. [Homoptera: Pseudococcidae]

3974 Diaspis cacti Comstock [Homoptera: Diaspididae]

3975 Trichochrous texanus LeConte [Coleoptera: Melyridae]

3976 Allorhina mutabilis Gory or G. & P. (Green fruit or peach beetle) [Coleoptera: Scarabaeidae]

3977 Moneilema crassum Horn [Coleoptera: Cerambycidae]

3978 Moneilema annulatum Say [Coleoptera: Cerambycidae]

3979 Moneilema semipunctatum LeConte [Coleoptera: Cerambycidae]

3980 Moneilema spoliatum Horn [Coleoptera: Cerambycidae]

3981 Coenopoeus palmeri LeConte [Coleoptera: Cerambycidae]

3982 Disonycha varicornis Horn [Coleoptera: Curculionidae]

3983 Gerstaeckeria bifasciata Gerstaecker [Coleoptera: Curculionidae]

3984 Gerstaeckeria nobilis LeConte [Coleoptera: Curculionidae]

3985 Gerstaeckeria porosa LeConte [Coleoptera: Curculionidae]

3986 Gerstaeckeria clathrata LeConte [Coleoptera: Curculionidae]

3987 Gerstaeckeria opuntiae Pierce [Coleoptera: Curculionidae]

3988 Gerstaeckeria cactophaga Pierce [Coleoptera: Curculionidae]

3989 Onychobaris mystica Casey [Coleoptera: Curculionidae]

3990 Cactophagus spinolae Gyllenhal [Coleoptera: Family?]

3991 Cactopinus hubbardi Schwarz [Coleoptera: Scolytidae]

3992 Apantesis arge Drury [Lepidoptera: Arctiidae]

3993 Chorizagrotis soror Smith [Lepidoptera: Noctuidae]

3994 Mimorista flavidissimalis Grote [Lepidoptera: Pyralidae]

3995 Cornifrons elautalis Grote [Lepidoptera: Pyralidae]

3996 Dicymolomia opuntialis Dyar [Lepidoptera: Pyralidae]

3997 Dicymolomia julianalis Walker [Lepidoptera: Pyralidae]

3998 Ozamia lucidalis Walker [Lepidoptera: Pyralidae]

3999 Melitara junctolinella Hulst [Lepidoptera: Pyralidae]

4000 Melitara fernaldialis Hulst [Lepidoptera: Pyralidae]

4001 Dyotopasta yumaella Kearfott [Lepidoptera: Tineidae]

4002 Polistes rubiginosus Lepeletier [Hymenoptera: Vespidae]

4003 Polistes flavus Cresson [Hymenoptera: Vespidae]

4004 Polistes texanus Cresson [Hymenoptera: Vespidae]

4005 Asphondylia betheli Cockerell [Diptera: Cecidomyiidae]

4006 Asphondylia arizonensis Felt [Diptera: Cecidomyiidae]

4007 Sesia tipuliformis Clerck (Currant cane borer) [Lepidoptera: Sesiidae] Immature/Adult Guild: Stem borer/? Overwintering Stage: Larvae Oviposition Medium: Bark surfaces Generations Per Year: 1

4008 Xylocrius cribratus Lax. [Coleoptera: Family?]

4009 Kalotermes arizonensis Snyder [Isoptera: Kalotermitidae] Immature/Adult Guild: Termite/Termite

4010 Kalotermes lighti Snyder [Isoptera: Kalotermitidae] Immature/Adult Guild: Termite/Termite

4011 Euaresta bellula [Diptera: Tephritidae]

4012 Euaresta stigmatica [Diptera: Tephritidae]

4013 Tomoplagia cressoni [Diptera: Tephritidae]

4014 Orellia occidentalis [Diptera: Tephritidae]

4015 Tephritis araneosa (Coquillett) [Diptera: Tephritidae]

4016 Euaresta aequalis [Diptera: Tephritidae]

4017 Eutreta pacifica [Diptera: Tephritidae]

4018 Euarestoides acutangula (Thomson) [Diptera: Tephritidae]

4019 Tephritis ovatipennis [Diptera: Tephritidae]

4020 Trypeta angustigena [Diptera: Tephritidae]

4021 Orellia undosa [Diptera: Tephritidae]

4022 Neaspilota brunneostigmata [Diptera: Tephritidae]

4023 Trupanea californica [Diptera: Tephritidae]

4024 Valentibulla californica [Diptera: Tephritidae]

4025 Trupanea pseudovicina [Diptera: Tephritidae]

4026 Euaresta bullans [Diptera: Tephritidae]

4027 Trupanea wheeleri [Diptera: Tephritidae]

4028 Acinia fucata [Diptera: Tephritidae]

4029 Tephritis californica [Diptera: Tephritidae]

4030 Eutreta baccharis [Diptera: Tephritidae]

4031 Euarestoides arnaudi Foote [Diptera: Tephritidae]

4032 Paracantha cultaris [Diptera: Tephritidae]

4033 Tephritis rufipennis [Diptera: Tephritidae]

4034 Tephritis arizonensis [Diptera: Tephritidae]

4035 Aciurina aplopappi [Diptera: Tephritidae]

4036 Tephritis signatipennis [Diptera: Tephritidae]

4037 Rhagoletis berberis [Diptera: Tephritidae]

4038 Neaspilota signifera [Diptera: Tephritidae]

4039 Aciurina trilitura [Diptera: Tephritidae]

4040 Eutreta hespera [Diptera: Tephritidae]

4041 Paracantha gentilis [Diptera: Tephritidae]

4042 Tephritis opacipennis [Diptera: Tephritidae]

4043 Trupanea imperfecta [Diptera: Tephritidae]

4044 Euaresta tapetis [Diptera: Tephritidae]

4045 Euarestoides flava [Diptera: Tephritidae]

4046 Procecidochares anthracina [Diptera: Tephritidae]

4047 Procecidochares stonei Blanc & Foote [Diptera: Tephritidae] Immature/Adult Guild: Gall former/? Generations Per Year: 1

4048 Tephritis labecula [Diptera: Tephritidae]

4049 Tephritis stigmatica (Coquillett) [Diptera: Tephritidae] Immature/Adult Guild: Flower feeder/?

4050 Rhagoletis tabellaria [Diptera: Tephritidae]

4051 Trupanea conjuncta [Diptera: Tephritidae]

4052 Dioxyna picciola [Diptera: Tephritidae]

4053 Paroxyna corpulenta [Diptera: Tephritidae]

4054 Paroxyna americana [Diptera: Tephritidae]

4055 Rhagoletis cingulata indifferens [Diptera: Tephritidae]

4056 Rhagoletis fausta [Diptera: Tephritidae]

4057 Rhagoletis ribicola [Diptera: Tephritidae]

4058 Rhagoletis basiola (Osten Sacken) [Diptera: Tephritidae]

4059 Orellia ruficauda [Diptera: Tephritidae]

4060 Pityokteines ornatus [Coleoptera: Scolytidae]

4061 Pityophthorus modicus [Coleoptera: Scolytidae]

4062 Cactopinus koebeli [Coleoptera: Scolytidae]

4063 Cactopinus pini [Coleoptera: Scolytidae]

4064 Carphoborus frontalis [Coleoptera: Scolytidae]

4065 Carphoborus simplex [Coleoptera: Scolytidae]

4066 Dendroctonus valens [Coleoptera: Scolytidae]

4067 Myeloborus keeni [Coleoptera: Scolytidae]

4068 Pityophthorus blandus [Coleoptera: Scolytidae]

4069 Pityophthorus confertus [Coleoptera: Scolytidae]

4070 Pityophthorus digestus [Coleoptera: Scolytidae]

4071 Pityophthorus grandis [Coleoptera: Scolytidae]

4072 Pityophthorus monophyllae [Coleoptera: Scolytidae]

4073 Pityophthorus punctifrons [Coleoptera: Scolytidae]

4074 Pityophthorus singularis [Coleoptera: Scolytidae]

4075 Pityophthorus tuberculatus [Coleoptera: Scolytidae]

4076 Aonidiella aurantii (Maskell) [Homoptera: Diaspididae]

4077 Aspidiotus hederae (Vallot) (Ivy or oleander scale) [Homoptera: Diaspididae] Immature/Adult Guild: Sap feeder/Sap feeder

4078 Parlatoria proteus (Curtis) [Homoptera: Diaspididae]

4079 Clavaspis covilleae (Ferris) [Homoptera: Diaspididae]

4080 Chrysomphalus bifasciculatus Ferris [Homoptera: Diaspididae]

4081 Fiorinia fioriniae (Targioni) [Homoptera: Diaspididae]

4082 Parlatoreopsis chinensis (Marlatt) [Homoptera: Diaspididae]

4083 Dynaspidiotus britannicus (Newstead) [Homoptera: Diaspididae]

4084 Parlatoria camelliae (Comstock) [Homoptera: Diaspididae]

4085 Chionaspis furfura (Fitch) (Scurfy scale) [Homoptera: Diaspididae]

4086 Chionaspis wistariae Cooley [Homoptera: Diaspididae]

4087 Diaspidiotus aesculi (Johnson) [Homoptera: Diaspididae]

4088 Aonidiella citrina (Coquillett) [Homoptera: Diaspididae]

4089 Aspidaspis densiflorae (Bremner) [Homoptera: Diaspididae]

4090 Parlatoria oleae (Colvee) [Homoptera: Diaspididae]

4091 Chrysomphalus dictyosperimi (Morgan) (Spanish red or dictyospermum scale) [Homoptera: Diaspididae]

4092 Diaspis boisduvalii Signoret [Homoptera: Diaspididae]

4093 Hemiberlesia cyanophyllii (Signoret) [Homoptera: Diaspididae]

4094 Unaspis euonymi (Comstock) [Homoptera: Diaspididae]

4095 Aonidomytilus variabilis Ferris [Homoptera: Diaspididae]

4096 Parlatoria pittospori Maskell [Homoptera: Diaspididae]

4097 Aonidomytilus bilobis Ferris [Homoptera: Diaspididae]

4098 Aonidomytilus concolor (Cockerell) (Concolor scale) [Homoptera: Diaspididae]

4099 Situlaspis atriplicis (Ferris) [Homoptera: Diaspididae]

4100 Nilotaspis halli (Green) [Homoptera: Diaspididae]

4101 Rhizaspidiotus dearnessi (Cockerell) [Homoptera: Diaspididae]

4102 Lindingaspis rossi (Maskell) [Homoptera: Diaspididae]

4103 Hemiberlesia popularum (Marlatt) [Homoptera: Diaspididae]

4104 Targionia bigeloviae (Cockerell) [Homoptera: Diaspididae]

4105 Lepidosaphes machili (Maskell) [Homoptera: Diaspididae]

4106 Diaspidiotus osborni (Newell & Cockerell) [Homoptera: Diaspididae]

4107 Chionaspis corni Cooley [Homoptera: Diaspididae]

4108 Chionaspis salicisnigrae (Walsh) (Black willow scale) [Homoptera: Diaspididae] Immature/Adult Guild: Sap feeder: bark/Sap feeder: bark

4109 Clavaspis disclusa Ferris [Homoptera: Diaspididae]

4110 Melanaspis obscura (Comstock) [Homoptera: Diaspididae]

4111 Parlatoria theae Cockerell [Homoptera: Diaspididae]

4112 Quadraspidiotus juglans-regiae (Comstock) [Homoptera: Diaspididae]

4113 Aspidaspis arctostaphyli (Cockerell & Robbins) [Homoptera: Diaspididae]

4114 Diaspis manzanitae (Whitney) [Homoptera: Diaspididae]

4115 Pallulaspis ephedrae Ferris [Homoptera: Diaspididae]

4116 Neopinnaspis harperi McKenzie [Homoptera: Diaspididae]

4117 Rugaspidiotus arizonicus (Cockerell) [Homoptera: Diaspididae]

4118 Pinnaspis strachani (Cooley) [Homoptera: Diaspididae]

4119 Hemiberlesia lataniae (Signoret) [Homoptera: Diaspididae]

4120 Pinnaspis aspidistrae (Signoret) (Aspidistra scale) [Homoptera: Diaspididae]

4121 Pinnaspis buxi (Bouche) [Homoptera: Diaspididae]

4122 Situlaspis daleae Ferris [Homoptera: Diaspididae]

4123 Xerophilaspis prosopidis (Cockerell) [Homoptera: Diaspididae]

4124 Parlatoria pergandii Comstock [Homoptera: Diaspididae]

4125 Diaspidiotus ancylus (Putnam) [Homoptera: Diaspididae]

4126 Diaspidiotus uvae (Comstock) [Homoptera: Diaspididae]

4127 Hemiberlesia howardi (Cockerell) [Homoptera: Diaspididae]

4128 Chionaspis americana (Johnson) [Homoptera: Diaspididae]

4129 Pseudaulacaspis pentagona (Targioni) [Homoptera: Diaspididae]

4130 Fiorinia juniperi (Bouche) [Homoptera: Diaspididae]

4131 Diaspidiotus coniferarum (Cockerell) [Homoptera: Diaspididae]

4132 Lineaspis cupressi (Coleman) [Homoptera: Diaspididae]

4133 Aonidia shastae (Coleman) [Homoptera: Diaspididae]

4134 Carulaspis minima (Targioni) [Homoptera: Diaspididae]

4135 Carulaspis visci (Schrank) (Juniper scale) [Homoptera: Diaspididae]

4136 Lepidosaphes maskelli (Cockerell) [Homoptera: Diaspididae]

4137 Rugaspdiotus nebulosos Ferris [Homoptera: Diaspididae]

4138 Aonidomytilus ceanothi (Ferris) [Homoptera: Diaspididae]

4139 Chionaspis sassceri Cockerell & Robbins [Homoptera: Diaspididae]

4140 Quadraspidiotus forbesi (Johnson) [Homoptera: Diaspididae]

4141 Aspidiotus spinosus Comstock [Homoptera: Diaspididae]

4142 Aulacaspis rosae (Bouche) (Rose scale) [Homoptera: Diaspididae]

4143 Selenaspidus articulatus (Morgan) [Homoptera: Diaspididae]

4144 Epidiaspis salcicola Ferris [Homoptera: Diaspididae]

4145 Lepidosaphes gloverii (Packard) [Homoptera: Diaspididae]

4146 Chrysomphalus ficus Ashmead [Homoptera: Diaspididae]

4147 Palonica pyramidata Uhler [Homoptera: Membracidae]

4148 Oncideres trinodatus Casey [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer: dead wood/Girdler Oviposition Medium: Bark incisions Generations Per Year: 1

4149 Oncideres pustulatus LeConte [Coleoptera: Buprestidae]

4150 Cinara edulis Wilson [Homoptera: Aphididae]

4151 Thecodiplosis cockerelli Felt [Diptera: Cecidomyiidae] Immature/Adult Guild: Gall former/?

4152 Oligotrophus betheli Felt [Diptera: Cecidomyiidae] Immature/Adult Guild: Gall former/?

4153 Halisidota maculata Hy. Edw. [Lepidoptera: Arctiidae] Immature/Adult Guild: Leaf feeder/?

4154 Notolophus antiqua Linnaeus [Lepidoptera: Liparidae] Immature/Adult Guild: Leaf feeder/?

4155 Stilpontia salicis Linnaeus [Lepidoptera: Liparidae] Immature/Adult Guild: Leaf feeder/? Overwintering Stage: Larvae,pupae Oviposition Medium: Bark surfaces Generations Per Year: 1

4156 Malacosoma californica (Packard) (California tent caterpillar) [Lepidoptera: Lasiocampidae] Immature/Adult Guild: Leaf feeder/?

4157 Malacosoma pluvialis Dyar (Western or coast tent caterpillar) [Lepidoptera: Lasiocampidae] Immature/Adult Guild: Leaf feeder/?

4158 Phyllonorycter salicifoliella Chambers [Lepidoptera: Gracilariidae] Immature/Adult Guild: Leaf miner/?

4159 Phyllonorycter apicinigrella Braun [Lepidoptera: Gracilariidae] Immature/Adult Guild: Leaf miner/?

4160 Phyllonorycter incanella Walsingham [Lepidoptera: Gracilariidae] Immature/Adult Guild: Leaf miner/?

4161 Cameraria umbellulariae Walsingham [Lepidoptera: Gracilariidae] Immature/Adult Guild: Leaf miner/?

4162 Neodiprion rowheri Midd. [Hymenoptera: Diprionidae] Immature/Adult Guild: Leaf feeder/?

4163 Cimbex rubida Cresson [Hymenoptera: Cimbicidae] Immature/Adult Guild: Leaf feeder/?

4164 Trichiosoma lanuginosa Norton [Hymenoptera: Cimbicidae] Immature/Adult Guild: Leaf feeder/?

4165 Galerucella decora Say (Western willow leaf beetle) [Coleoptera: Chrysomelidae] Immature/Adult Guild: Leaf feeder/?

4166 Lina lapponica Linnaeus [Coleoptera: Chrysomelidae] Immature/Adult Guild: Leaf feeder/?

4167 Phloeosinus utahensis Sw. [Coleoptera: Scolytidae] Immature/Adult Guild: Bark beetle/Bark beetle

4168 Phloeosinus scopulorum Sw. [Coleoptera: Scolytidae]

4169 Alniphagus aspericollis LeConte (Alder bark beetle) [Coleoptera: Scolytidae] Immature/Adult Guild: Bark beetle/Bark beetle Oviposition Medium: Galleries Generations Per Year: 2

4170 Aegeria americana Beut. (Alder borer) [Lepidoptera: Sesiidae] Immature/Adult Guild: Wood borer/?

4171 Aegeria tibialis Harr. [Lepidoptera: Sesiidae] Immature/Adult Guild: Wood borer/?

4172 Aegeria pacifica Hy. Edw. [Lepidoptera: Sesiidae] Immature/Adult Guild: Wood borer/?

4173 Alcathoe apiformis Clerck [Lepidoptera: Sesiidae] Immature/Adult Guild: Wood borer/?

4174 Gnathotrichus alni Blkm. [Coleoptera: Scolytidae] Immature/Adult Guild: Ambrosia beetle/Ambrosia beetle

4175 Trypodendron cavifrons Mann. [Coleoptera: Scolytidae] Immature/Adult Guild: Ambrosia beetle/Ambrosia beetle

4176 Trypodendron retusus Lee [Coleoptera: Scolytidae] Immature/Adult Guild: Ambrosia beetle/Ambrosia beetle

4177 Buprestis viridisuturalis Nicolay & Weiss [Coleoptera: Buprestidae] Immature/Adult Guild: Wood borer: dead wood/?

4178 Dicerca divaricata Say [Coleoptera: Buprestidae] Immature/Adult Guild: Wood borer/?

4179 Prionus californicus Mots. (California prionus) [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

4180 Necydalis cavipennis LeConte [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

4181 Cyllene antennata White [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

4182 Ephedrodoma spp. Polhemus & Polhemus [Hemiptera: Miridae]

4183 Ephedrodoma multilineata Polhemus & Polhemus [Hemiptera: Miridae]

4184 Agrilus anxius Gory [Coleoptera: Buprestidae] Immature/Adult Guild: Wood borer/Wood borer Oviposition Medium: Bark surfaces

4185 Lina interrupta Fabricius (Willow leaf beetle) [Coleoptera: Chrysomelidae] Immature/Adult Guild: Skeletonizer/?

4186 Lina californica Rogers (California willow beetle) [Coleoptera: Chrysomelidae]

4187 Procryphalus utahensis Hopkins [Coleoptera: Scolytidae] Immature/Adult Guild: Bark beetle/Bark beetle

4188 Asphondylia ambrosiae Gagne [Diptera: Cecidomyiidae] Immature/Adult Guild: Gall former/?

4189 Contarinia partheniicola (Cockerell) [Diptera: Cecidomyiidae] Immature/Adult Guild: Gall former/?

4190 Adaina ambrosiae (Murtfeldt) [Lepidoptera: Pterophoridae] Immature/Adult Guild: Leaf feeder/? Oviposition Medium: Leaf surfaces Generations Per Year: Several

4191 Rehnia cerberus [Orthoptera: Tettigoniidae]

4192 Eremopedes bilineatus [Orthoptera: Tettigoniidae]

4193 Ateloplus splendidus [Orthoptera: Tettigoniidae]

4194 Anoplodusa arizonensis [Orthoptera: Tettigoniidae]

4195 Idiostatus inyo [Orthoptera: Tettigoniidae]

4196 Idiostatus inermis [Orthoptera: Tettigoniidae]

4197 Idiostatus elegans [Orthoptera: Tettigoniidae]

4198 Idiostatus nevadensis [Orthoptera: Tettigoniidae]

4199 Idiostatus magnificus [Orthoptera: Tettigoniidae]

4200 Idiostatus varegatus [Orthoptera: Tettigoniidae]

4201 Idiostatus hendersoni [Orthoptera: Tettigoniidae]

4202 Neduba carinata [Orthoptera: Tettigoniidae]

4203 Aglaothorax segnis [Orthoptera: Tettigoniidae]

4204 Ateloplus hesperus [Orthoptera: Tettigoniidae]

4205 Rehnia victoria [Orthoptera: Tettigoniidae]

4206 Rehnia spp. [Orthoptera: Tettigoniidae]

4207 Eremopedes spp. [Orthoptera: Tettigoniidae]

4208 Eremopedes ephippiatus [Orthoptera: Tettigoniidae]

4209 Ateloplus schwartzi [Orthoptera: Tettigoniidae]

4210 Aglaothorax armiger [Orthoptera: Tettigoniidae]

4211 Neduba castanea [Orthoptera: Tettigoniidae]

4212 Ateloplus minor [Orthoptera: Tettigoniidae]

4213 Pediodectes spp. [Orthoptera: Tettigoniidae]

4214 Pediodectes bruneri [Orthoptera: Tettigoniidae]

4215 Capnobotes occidentalis [Orthoptera: Tettigoniidae]

4216 Zycloptera atripennis [Orthoptera: Tettigoniidae]

4217 Ateloplus luteus [Orthoptera: Tettigoniidae]

4218 Trogloderus costanus LeConte [Coleoptera: Tenebrionidae]

4219 Philolithus pantex (Casey) [Coleoptera: Tenebrionidae]

4220 Asidina semilaevis (Horn) [Coleoptera: Tenebrionidae]

4221 Leptalia macilenta (Mannerheim) [Coleoptera: Cerambycidae]

4222 Neoclytus resplendens Linsley [Coleoptera: Cerambycidae]

4223 Ammanus vittigera LeConte [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

4224 Crossidius discoideus blandi Casey [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

4225 Neoclytus balteatus LeConte [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

4226 Prionus integer LeConte [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

4227 Semanotus juniperi (Fisher) [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

4228 Semanotus ligneus conformis (Casey) [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

4229 Toxotus obtusus LeConte [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

4230 Typocerus balteatus Horn [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

4231 Megacheuma brevipennis (LeConte) [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

4232 Neotylopterus pallidus (LeConte) [Coleoptera: Curculionidae]

Immature/Adult Guild: Internal seed feeder/? Generations Per Year: 1

4233 Colias meadii Edwards [Lepidoptera: Pieridae]

4234 Colias eurytheme Boisduvall [Lepidoptera: Pieridae]

4235 Centrodontus atlas atlas Cook [Homoptera: Membracidae]

4236 Centrodontus atlas paucivenosus Cook [Homoptera: Membracidae]

4237 Centrodontus atlas reticulatus Cook [Homoptera: Membracidae]

4238 Moneilema crassa LeConte [Coleoptera: Cerambycidae]

4239 Eurytoma brevitergis Bugbee [Hymenoptera: Eurytomidae]
Immature/Adult Guild: Ectoparasite,phytophagous/?

4240 Diastrophus kincaidii Gillette [Hymenoptera: Cynipidae] Immature/Adult Guild: Gall former: stems/?
Overwintering Stage: Prepupae
Oviposition Medium: Xylem,phloem,cortex
Generations Per Year: 1

4241 Eurytoma chrysothamni Bugbee [Hymenoptera: Eurytomidae]
Immature/Adult Guild: Endoparasite/?

4242 Dioryctria spp. [Lepidoptera: Pyralidae]

4243 Rhyacionia neomexicana Dyar [Lepidoptera: Olethreutidae]

4244 Chionaspis pinifoliae (Fitch) [Homoptera: Diaspididae]

4245 Matsucoccus paucicatrices Mor. [Homoptera: Margarodidae]

4246 Cinara atra Gillette & Palmer [Homoptera: Aphididae]

4247 Liometopum apiculatum luctuosum Whlr. [Hymenoptera: Formicidae]

4248 Coloradia spp. [Lepidoptera: Saturniidae]

4249 Gloveria spp. [Lepidoptera: Lasiocampidae]

4250 Neodiprion spp. [Hymenoptera: Diprionidae]

4251 Okanagana magnifica Davis [Homoptera: Cicadidae]

4252 Cinara terminalis (Gillette & Palmer) [Homoptera: Aphididae]

4253 Dendroctonus barberi Hopkins [Coleoptera: Scolytidae]

4254 Pityophthorus agnatus Blackm. [Coleoptera: Scolytidae]

4255 Pityophthorus comptus Blackm. [Coleoptera: Scolytidae]

4256 Pityophthorus deletus LeConte [Coleoptera: Scolytidae]

4257 Pityophthorus immanis Blackm. [Coleoptera: Scolytidae]

4258 Pityophthorus infulatus Blackm. [Coleoptera: Scolytidae]

4259 Pityophthorus inquietus Blackm. [Coleoptera: Scolytidae]

4260 Pityophthorus mollis Blackm. [Coleoptera: Scolytidae]

4261 Pityophthorus ornatus Blackm. [Coleoptera: Scolytidae]

4262 Pityophthorus schwarzi Blackm. [Coleoptera: Scolytidae]

4263 Pityophilus barbatus Blackm. [Coleoptera: Scolytidae]

4264 Ips spp. [Coleoptera: Scolytidae]

4265 Ips lecontei Sw. [Coleoptera: Scolytidae]

4266 Acanthocinus spp. [Coleoptera: Cerambycidae]

4267 Acanthocinus spectabilis LeConte [Coleoptera: Cerambycidae]

4268 Monochamus spp. [Coleoptera: Cerambycidae]

4269 Temnochila spp. [Coleoptera: Trogositidae]

4270 Aulonium longum LeConte [Coleoptera: Colydiidae]

4271 Platysoma punctigerum LeConte [Coleoptera: Histeridae]

4272 Hypophloeus spp. [Coleoptera: Tenebrionidae]

4273 Conotrachelus spp. [Coleoptera: Curculionidae]

4274 Xyela spp. [Hymenoptera: Xyelidae]

4275 Xyela minor Nort. [Hymenoptera: Xyelidae]

4276 Eurytoma ceanothi Bugbee [Hymenoptera: Eurytomidae]
Immature/Adult Guild: Internal seed feeder/?

4277 Orthopelma californicum Ashmead [Hymenoptera: Ichneumonidae]

4278 Artholytus spp. [Hymenoptera: Pteromalidae]

4279 Eupelmella vesicularis (Retz.) [Hymenoptera: Eupelmidae]

4280 Ormyrus spp. [Hymenoptera: Ormyridae]

4281 Lachnus salignus (Gm.) [Homoptera: Aphididae]

4282 Clavigerus smithae (Mon.) [Homoptera: Aphididae]

4283 Aphis sorensoni Knowlton [Homoptera: Aphididae]

4284 Aphis saliceti Kaltenbach [Homoptera: Aphididae]

4285 Aphis vorabonnevillus Knowlton & Smtih [Homoptera: Aphididae]

4286 Cavariella essigi (Gillette) [Homoptera: Aphididae]

4287 Chrysobothris ignicollis Horn [Coleoptera: Buprestidae]

4288 Agrilus angelicus Horn (Oak twig girdler) [Coleoptera: Buprestidae]
Immature/Adult Guild: Girdler/Leaf feeder
Oviposition Medium: Twig surfaces
Generations Per Year: 1/2

4289 Toxotus uteanus Casey [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

4290 Leptacmaeops cubitalis (LeConte) [Coleoptera: Cerambycidae]

4291 Callidium antennatum hesperum Casey [Coleoptera: Cerambycidae]

4292 Xylotrechus annosus (Say) [Coleoptera: Cerambycidae]

4293 Oxoplus jocosus Horn [Coleoptera: Cerambycidae]

4294 Phytophaga painteri Felt [Diptera: Cecidomyiidae] Immature/Adult Guild: Gall former/? Generations Per Year: 1

4295 Phytophaga texana Felt [Diptera: Cecidomyiidae] Immature/Adult Guild: Gall former/? Generations Per Year: 1

4296 Sackenomyia packardi Felt [Diptera: Cecidomyiidae]

4297 Asphondylia clematidis Felt [Diptera: Cecidomyiidae] Immature/Adult Guild: Gall former/?

4298 Asphondylia prosopidis Cockerell [Diptera: Cecidomyiidae] Immature/Adult Guild: Gall former/?

4299 Phaeogenes walshiae walshiae Ashmead [Hymenoptera: Ichneumonidae]
Immature/Adult Guild: Endoparasite/?

4300 Coelopencyrtus hylaei Burks [Hymenoptera: Encyrtidae]

4301 Trypoxylon frigidum Smith [Hymenoptera: Sphecidae]

4302 Rhydinofoenus spp. [Hymenoptera: Gasteruptiidae]

4303 Rhydinofoenus floridanus bradleyi Townes [Hymenoptera: Gasteruptiidae]

4304 Tubulifera spp. [Thysanoptera: Family?]

4305 Leptothorax curvispinosus Mayr [Hymenoptera: Formicidae]

4306 Tetralonia venusta Timberlake [Hymenoptera: Anthophoridae]

4307 Coniontis setosa [Coleoptera: Tenebrionidae]

4308 Eleodes spp. [Coleoptera: Tenebrionidae]

4309 Stenodontes dasystomus Say [Coleoptera: Cerambycidae]

4310 Smodicum cucujiforme Say [Coleoptera: Cerambycidae]

4311 Achryson surinamum (Linnaeus) [Coleoptera: Cerambycidae]

4312 Chion cinctus Drury [Coleoptera: Cerambycidae]

4313 Eburia stigmatica Chev. [Coleoptera: Cerambycidae]

4314 Eburia mutica LeConte [Coleoptera: Cerambycidae]

4315 Elaphidion incertum Newn. [Coleoptera: Cerambycidae]

4316 Elaphidion mimeticum Schaeffer [Coleoptera: Cerambycidae]

4317 Anoplium moestum LeConte [Coleoptera: Cerambycidae]

4318 Leptura gigas LeConte [Coleoptera: Cerambycidae]

4319 Megacyllene caryae Gahan [Coleoptera: Cerambycidae]

4320 Neoclytus mucronatus (Fabricius) [Coleoptera: Cerambycidae]

4321 Neoclytus abrreviatus Schaeffer [Coleoptera: Cerambycidae]

4322 Euderces exilis Casey [Coleoptera: Cerambycidae]

4323 Rhopalophora laevicollis LeConte [Coleoptera: Cerambycidae]

4324 Aphis zonassa Knowlton [Homoptera: Aphididae]

4325 Poecilonota ferrea Melsh. [Coleoptera: Buprestidae]

4326 Trachykele blondeli Mars. [Coleoptera: Buprestidae] Immature/Adult Guild: Wood borer/?

4327 Polycesta elata LeConte [Coleoptera: Buprestidae]

4328 Polycesta velasco L. & G. or Cast. [Coleoptera: Buprestidae] Immature/Adult Guild: Wood borer: dead,injured wood/?

4329 Acmaeodera amabilis Horn [Coleoptera: Buprestidae] Immature/Adult Guild: Wood borer: dead wood/?

4330 Acmaeodera plagiaticauda Horn [Coleoptera: Buprestidae]

4331 Acmaeodera cuneata Fall [Coleoptera: Buprestidae] Immature/Adult Guild: Wood borer: dead,injured wood/?

4332 Chrysophana placida LeConte [Coleoptera: Buprestidae]

4333 Agrilus niveiventris Horn [Coleoptera: Buprestidae]

4334 Agrilus granulatus Say [Coleoptera: Buprestidae]

4335 Agrilus acutipennis Mann. [Coleoptera: Buprestidae]

4336 Volucella esuriens (Fabricius) (Mexican cactus fly) [Diptera: Syrphidae] Immature/Adult Guild: Scavenger/Flower feeder

4337 Eurytoma rubribacca Bugbee [Hymenoptera: Eurytomidae]

4338 Lonchaea striatifrons Malloch. [Diptera: Lonchaeidae]

4339 Desmometopa spp. [Diptera: Milichiidae]

4340 Volucella isabellina Williston [Diptera: Syrphidae]

4341 Volucella apicifera Townsend [Diptera: Syrphidae]

4342 Culicoides copiosus Root & Hoffman [Diptera: Ceratopogonidae]

4343 Spongovostox apicedentatus (Caudell) [Dermaptera: Labiidae]

4344 Belonuchus punctiventris Casey [Coleoptera: Staphylinidae]

4345 Aleochara ponderosa Casey [Coleoptera: Staphylinidae]

4346 Xanthopygus cacti Horn [Coleoptera: Staphylinidae]

4347 Stilomedon spp. [Coleoptera: Staphylinidae]

4348 Physetoporus grossulus (LeConte) [Coleoptera: Staphylinidae]

4349 Hololepta yucateca Marseuil [Coleoptera: Histeridae]

4350 Hololepta spp. [Coleoptera: Histeridae]

4351 Carcinops spp. [Coleoptera: Histeridae]

4352 Cynaeus angustus (LeConte) [Coleoptera: Tenebrionidae]

4353 Lithurgus echinocacti Cockerell [Hymenoptera: Megachilidae]

4354 Lithurgus gibbosus Smith [Hymenoptera: Megachilidae]

4355 Lithurgus apicalis Cresson [Hymenoptera: Megachilidae]

4356 Heriades gracilior Cockerell [Hymenoptera: Megachilidae]

4357 Ashmeadiella opuntiae (Cockerell) [Hymenoptera: Megachilidae]

4358 Ashmeadiella cactorum (Cockerell) [Hymenoptera: Megachilidae]

4359 Augochlora neglectula Cockerell [Hymenoptera: Halictidae]

4360 Idiocerus femoratus Ball [Homoptera: Cicadellidae]

4361 Erythroneura ziczac Walsh [Homoptera: Cicadellidae]

4362 Oecanthus argentinus Saussure [Orthoptera: Gryllidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

4363 Chlamydatus suavis (Reuter) [Hemiptera: Miridae] Immature/Adult Guild: Leaf feeder/Leaf feeder

4364 Lygus atriflavus Knight [Hemiptera: Miridae] Immature/Adult Guild: Flower,leaf,stem feeder/Flower,leaf,stem feeder

4365 Murgantia histrionica (Hahn) [Hemiptera: Pentatomidae] Immature/Adult Guild: Leaf,stem feeder/Leaf,stem feeder

4366 Trialeurodes abutilonea (Haldeman) [Homoptera: Aleyrodidae]

4367 Dactynotus katonkae (Hottes) [Homoptera: Aphididae]

4368 Aceratagallia nitidula Oman [Homoptera: Cicadellidae]

4369 Gyponana hasta DeLong [Homoptera: Cicadellidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

4370 Stobaera caldwelli Kramer [Homoptera: Delphacidae] Immature/Adult Guild: Leaf,stem feeder/Leaf,stem feeder

4371 Stobaera concinna (Stal) [Homoptera: Delphacidae] Immature/Adult Guild: Leaf,stem feeder/Leaf,stem feeder

4372 Icerya purchasi Maskell (Cottony cushion scale or fluted scale) [Homoptera: Margarodidae] Immature/Adult Guild: Stem feeder/Stem feeder

4373 Spissistilus franciscans nigricans (Van Duzee) [Homoptera: Membracidae] Immature/Adult Guild: Stem feeder/Stem feeder

4374 Tortistilus pacificus (Van Duzee) [Homoptera: Membracidae] Immature/Adult Guild: Stem feeder/Stem feeder

4375 Vanduzea triguttata (Burmeister) [Homoptera: Membracidae] Immature/Adult Guild: Stem feeder/Stem feeder

4376 Phenacoccus solani Ferris [Homoptera: Pseudococcidae] Immature/Adult Guild: Crown,root,stem feeder/Crown,root,stem feeder

4377 Spilococcus eriogoni (Ehrhorn) [Homoptera: Pseudococcidae] Immature/Adult Guild: Root,stem feeder/Root,stem feeder

4378 Brachmia subalbusella (Chambers) [Lepidoptera: Gelechiidae] Immature/Adult Guild: Leaf feeder/?

4379 Gnorimoschema sapharinella (Chambers) [Lepidoptera: Gelechiidae] Immature/Adult Guild: Leaf feeder/?

4380 Heliothis virescens (Fabricius) [Lepidoptera: Noctuidae] Immature/Adult Guild: Flower feeder/?

4381 Schinia sexplagiata Smith [Lepidoptera: Noctuidae] Immature/Adult Guild: Flower feeder/?

4382 Spodoptera ornithogalli (Guenee) [Lepidoptera: Noctuidae] Immature/Adult Guild: Leaf feeder/?

4383 Tarachidia candefacta (Hubner) [Lepidoptera: Noctuidae] Immature/Adult Guild: Leaf feeder/?

4384 Phalonia spp. [Lepidoptera: Phaloniidae] Immature/Adult Guild: Stem feeder/?

4385 Frechinia laetalis (Barnes & McDunnough) [Lepidoptera: Pyralidae] Immature/Adult Guild: Leaf feeder/?

4386 Platynota stultana (Walsingham) [Lepidoptera: Tortricidae] Immature/Adult Guild: Leaf feeder/?

4387 Trigonorhinus tomentosus (Say) [Coleoptera: Anthribidae] Immature/Adult Guild: ?/Flower feeder

4388 Trirhabda spp. [Coleoptera: Chrysomelidae] Immature/Adult Guild: ?/Leaf feeder

4389 Baris dilatata Casey [Coleoptera: Curculionidae] Immature/Adult Guild: ?/Leaf,stem feeder

4390 Cleonus albovestitus Casey [Coleoptera: Curculionidae] Immature/Adult Guild: ?/Leaf feeder

4391 Cleonus lobigerinus Casey [Coleoptera: Curculionidae] Immature/Adult Guild: ?/Leaf feeder

4392 Microlarinus lareynii (DuVal) [Coleoptera: Curculionidae] Immature/Adult Guild: ?/Leaf feeder

4393 Smicronyx abnormis Dietz [Coleoptera: Curculionidae] Immature/Adult Guild: ?/Flower,leaf,stem feeder

4394 Calycomyza ambrosiae (Frick) [Diptera: Agromyzidae]

4395 Contarinia spp. [Diptera: Cecidomyiidae]

4396 Microlarinus lypriformis (Wollaston) [Coleoptera: Curculionidae]

4397 Schistocerca vaga vaga (Scudder) [Orthoptera: Acrididae] Immature/Adult Guild: Leaf feeder/Leaf feeder

4398 Haplothrips robustus Bagnell [Thysanoptera: Thripidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

4399 Ceratocapsus fuscosignatus Knight [Hemiptera: Miridae] Immature/Adult Guild: Leaf,stem feeder/Leaf,stem feeder

4400 Irbisia pacifica (Uhler) [Hemiptera: Miridae] Immature/Adult Guild: Leaf,stem feeder/Leaf,stem feeder

4401 Lygus shulli Knight [Hemiptera: Miridae] Immature/Adult Guild: Leaf,stem feeder/Leaf,stem feeder

4402 Phytocoris canescens Reuter [Hemiptera: Miridae] Immature/Adult Guild: Leaf feeder/Leaf feeder

4403 Pseudatomoscelis seriatus (Reuter) [Hemiptera: Miridae] Immature/Adult Guild: Leaf feeder/Leaf feeder

4404 Thyanta rugulosus (Say) [Hemiptera: Pentatomidae] Immature/Adult Guild: Leaf,stem feeder/Leaf,stem feeder

4405 Piesma cinereum (Say) [Hemiptera: Piesmatidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

4406 Sphyrocoris punctellus (Stal) [Hemiptera: Scutelleridae] Immature/Adult Guild: Stem feeder/Stem feeder

4407 Aceratagallia lyrata (Baker) [Homoptera: Cicadellidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

4408 Aceratagallia vulgaris Oman [Homoptera: Cicadellidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

4409 Draeculacephala minerva Ball [Homoptera: Cicadellidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

4410 Hordinia circellata (Baker) [Homoptera: Cicadellidae] Immature/Adult Guild: Stem feeder/Stem feeder

4411 Stobaera tricarinata (Say) [Homoptera: Delphacidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

4412 Campylenchia curvata (Fabricius) [Homoptera: Membracidae] Immature/Adult Guild: Stem feeder/Stem feeder

4413 Tortistilus albidosparsa (Stal) [Homoptera: Membracidae] Immature/Adult Guild: Stem feeder/Stem feeder

4414 Puto mimicus McKenzie [Homoptera: Pseudococcidae] Immature/Adult Guild: Flower,leaf feeder/Flower,leaf feeder

4415 Eupithecia spp. [Lepidoptera: Geometridae]

4416 Autographa spp. [Lepidoptera: Noctuidae]

4417 Peridroma saucia (Hubner) [Lepidoptera: Noctuidae] Immature/Adult Guild: Leaf feeder/?

4418 Martyrhilda gracilis (Walsingham) [Lepidoptera: Oecophoridae]

4419 Epiblema strenuana Walker [Lepidoptera: Olethreutidae] Immature/Adult Guild: Stem feeder/?

4420 Frechinia spp. [Lepidoptera: Pyralidae] Immature/Adult Guild: Leaf feeder/?

4421 Microrhopala xerene Newman [Coleoptera: Chrysomelidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

4422 Ceutorhynchus spp. [Coleoptera: Chrysomelidae]

4423 Cleonus jacobinus (Casey) [Coleoptera: Curculionidae] Immature/Adult Guild: ?/Leaf feeder

4424 Cylindrocopturus adspersus (LeConte) [Coleoptera: Curculionidae] Immature/Adult Guild: ?/Leaf feeder

4425 Lixus perforatus LeConte (Wormwood weevil) [Coleoptera: Curculionidae] Immature/Adult Guild: Stem borer/Leaf feeder

4426 Pantomorus cervinus Boheman [Coleoptera: Curculionidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

4427 Smicronyx californicus Dietz [Coleoptera: Curculionidae] Immature/Adult Guild: ?/Leaf feeder

4428 Liriomyza brassicae (Riley) [Diptera: Agromyzidae]

4429 Liriomyza munda (Frick) [Diptera: Agromyzidae]

4430 Melanagromyza splendida Frick [Diptera: Agromyzidae]

4431 Phytobia jucunda (Wulp) [Diptera: Agromyzidae]

4432 Phytomyza synegenesiae (Hardy) [Diptera: Agromyzidae]

4433 Harmostes fraterculus (Say) [Hemiptera: Rhopalidae] Immature/Adult Guild: Leaf,stem feeder/Leaf,stem feeder

4434 Spyhyrocoris obliquus (Germar) [Hemiptera: Scutelleridae] Immature/Adult Guild: Leaf,stem feeder/Leaf,stem feeder

4435 Empoasca lauta DeLong [Homoptera: Cicadellidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

4436 Lystridea nuda Oman [Homoptera: Cicadellidae] Immature/Adult Guild: Leaf feeder/?

4437 Dictyssa obliqua Ball [Homoptera: Issidae] Immature/Adult Guild: Stem feeder/Stem feeder

4438 Tischeria spp. [Lepidoptera: Tischeriidae]

4439 Exema deserti Pierce [Coleoptera: Chrysomelidae] Immature/Adult Guild: Leaf feeder/?

4440 Ceratagallia lobata Oman [Homoptera: Cicadellidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

4441 Steatococcus spp. [Homoptera: Margarodidae]

4442 Zygogramma tortuosa Rogers [Coleoptera: Chrysomelidae]

4443 Smicronyx imbricatus Casey [Coleoptera: Curculionidae] Immature/Adult Guild: Leaf,stem feeder/Leaf,stem feeder

4444 Dicyphus elongatus Van Duzee [Hemiptera: Miridae] Immature/Adult Guild: Flower,leaf feeder/Flower,leaf feeder

4445 Heliococcus deserticola Miller [Homoptera: Pseudococcidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

4446 Trichoptilus californicus (Walsingham) [Lepidoptera: Pterophoridae] Immature/Adult Guild: Flower,fruit,leaf feeder/?

4447 Trupanea spp. [Diptera: Tephritidae]

4448 Platyptilia spp. [Lepidoptera: Pterophoridae]

4449 Trialeurodes colcordae Russell [Homoptera: Aleyrodidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

4450 Dactynotus spp. [Homoptera: Aphididae]

4451 Aceratagallia truncata Oman [Homoptera: Cicadellidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

4452 Ceratagallia longipes Oman [Homoptera: Cicadellidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

4453 Orthezia ferrisi Morrison [Homoptera: Ortheziidae] Immature/Adult Guild: Leaf,stem feeder/Leaf,stem feeder

4454 Recurvaria spp. [Lepidoptera: Gelechiidae]

4455 Animmonmyia smithi (Pearsall) [Lepidoptera: Geometridae] Immature/Adult Guild: Leaf feeder/?

4456 Glaucina ochrofuscaria (Grossbeck) [Lepidoptera: Geometridae] Immature/Adult Guild: Leaf feeder/?

4457 Synchlora frondaria avidaria Pearsall [Lepidoptera: Geometridae] Immature/Adult Guild: Flower feeder/?

4458 Conochares arizonae (Henry Edwards) [Lepidoptera: Noctuidae] Immature/Adult Guild: Leaf feeder/?

4459 Oidaematophorus inconditus (Walsingham) [Lepidoptera: Pterophoridae] Immature/Adult Guild: Stem feeder/?

4460 Trigonorhinus tomentosus irregularis (Tanaro) [Coleoptera: Anthribidae] Immature/Adult Guild: ?/Flower,leaf feeder

4461 Cortodera falsa (LeConte) [Coleoptera: Cerambycidae]

4462 Altica torquata LeConte [Coleoptera: Chrysomelidae] Immature/Adult Guild: ?/Flower,leaf feeder

4463 Baris spp. [Coleoptera: Curculionidae]

4464 Encyllus spp. [Coleoptera: Curculionidae]

4465 Lygus communis Knight [Hemiptera: Miridae] Immature/Adult Guild: Leaf,stem feeder/Leaf,stem feeder

4466 Lygus nigrosignatus (Knight) [Hemiptera: Miridae] Immature/Adult Guild: Leaf,stem feeder/Leaf,stem feeder

4467 Aceratagallia pallida Oman [Homoptera: Cicadellidae] Immature/Adult Guild: ?/Stem feeder

4468 Ballana vesca (Ball) [Homoptera: Cicadellidae] Immature/Adult Guild: Leaf,stem feeder/Leaf,stem feeder

4469 Stobaera muiri Kramer [Homoptera: Delphacidae] Immature/Adult Guild: Leaf,stem feeder/Leaf,stem feeder

4470 Stictocephala basalis (Walker) [Homoptera: Membracidae] Immature/Adult Guild: ?/Stem feeder

4471 Chorizococcus abroniae McKenzie [Homoptera: Pseudococcidae] Immature/Adult Guild: ?/Crown feeder

4472 Apantesis proxima autholea (Boisduval) [Lepidoptera: Arctiidae] Immature/Adult Guild: Leaf feeder/?

4473 Cosymbia serrulata Packard [Lepidoptera: Geometridae] Immature/Adult Guild: Flower feeder/?

4474 Heliothis phloxiphaga (Grote & Robinson) [Lepidoptera: Noctuidae] Immature/Adult Guild: Flower feeder/?

4475 Lacinipolia olivacea (Morris) [Lepidoptera: Noctuidae] Immature/Adult Guild: Leaf feeder/?

4476 Trigonoscuta spp. [Coleoptera: Curculionidae]

4477 Liriomyza langei Frick [Diptera: Agromyzidae]

4478 Helobia hybrida Meigen [Diptera: Tipulidae]

4479 Tipula dejecta Walker [Diptera: Tipulidae]

4480 Scatopse spp. [Diptera: Bibionidae]

4481 Platypalpus trivialis Loew [Diptera: Bombyliidae]

4482 Copestylum marginatum (Say) [Diptera: Syrphidae]

4483 Lucilia sericata Mg. [Diptera: Muscidae]

4484 Helina lucorum Fall [Diptera: Anthomyiidae]

4485 Hylemya cilicrura Rondani [Diptera: Anthomyiidae]

4486 Scatophaga stercoraria (Linnaeus) [Diptera: Anthomyiidae]

4487 Euaresta abstersa Loew [Diptera: Tephritidae]

4488 Drosophila repleta Woll. [Diptera: Drosophilidae]

4489 Zenillia confinis Fall [Diptera: Tachinidae]

4490 Formica pilicornis Emery [Hymenoptera: Formicidae]

4491 Mutilla orcus Cresson [Hymenoptera: Mutillidae]

4492 Bembix comata Parker [Hymenoptera: Sphecidae]

4493 Xylocopa varipuncta Patton [Hymenoptera: Anthophoridae]

4494 Culicella impatiens Walker [Diptera: Culicidae]

4495 Melanostoma stegnum Say [Diptera: Syrphidae]

4496 Syrphus opinator Osten Sacken [Diptera: Syrphidae]

4497 Asemosyrphus mexicanus Macq. [Diptera: Syrphidae]

4498 Admontia degreeiodies Coquillett [Diptera: Tachinidae]

4499 Admontia pergandei Coquillett [Diptera: Tachinidae]

4500 Sarcophaga quadrisetosa Coquillett [Diptera: Sarcophagidae]

4501 Suillia limbata Thombs. [Diptera: Anthomyiidae]

4502 Toxomerus spp. [Diptera: Syrphidae]

4503 Crabro spp. [Hymenoptera: Sphecidae]

4504 Sphacrophoria melanosa Will. [Diptera: Syrphidae]

4505 Toxomerus geminatus Say [Diptera: Family?]

4506 Solenopsis geminata Say [Hymenoptera: Formicidae]

4507 Pseudomasaris edwardsii (Cresson) [Hymenoptera: Vespidae]

4508 Psammophila luctuosa (Smith) [Hymenoptera: Family?]

4509 Halictus robustus Crawford [Hymenoptera: Halictidae]

4510 Halictoides mulleri Cockerell [Hymenoptera: Family?]

4511 Colletes californicus Provancher [Hymenoptera: Colletidae]

4512 Xylocopa orpifex Smith [Hymenoptera: Anthophoridae]

4513 Ceratina punctigena Cockerell [Hymenoptera: Megachilidae]

4514 Bombus californicus Smith [Hymenoptera: Apidae]

4515 Andrena mimetica Cockerell [Hymenoptera: Andrenidae]

4516 Lispa tentaculata DeG. [Diptera: Anthomyiidae]

4517 Discocerina spp. [Diptera: Ephydridae]

4518 Pepsis formosa Say [Hymenoptera: Pompilidae]

4519 Polistes aurifer [Hymenoptera: Vespidae]

4520 Sminthurus spp. [Collembola: Sminthuridae]

4521 Aeoloplus tenuipennis tenuipennis Scudder [Orthoptera: Acrididae]

4522 Trimerotropis pallidipennis pallidipennis (Burmeister) [Orthoptera: Acrididae]

4523 Xanthippus lateritius Saussure [Orthoptera: Acrididae]

4524 Ceratagallia artemisia Oman [Homoptera: Cicadellidae]

4525 Errhomus aridus (Ball) [Homoptera: Cicadellidae]

4526 Eutettix insanus Ball [Homoptera: Cicadellidae]

4527 Exitianus obscurinervis (Stal.) [Homoptera: Cicadellidae]

4528 Deserta bipunctata Ball [Homoptera: Fulgoridae]

4529 Oecleus fulvidorsum Ball [Homoptera: Fulgoridae]

4530 Orgerius minor Ball [Homoptera: Fulgoridae]

4531 Scolops uhleri marginatus Ball [Homoptera: Fulgoridae]

4532 Monoxia spp. [Coleoptera: Chrysomelidae]

4533 Pachybrachis spp.(=Pachybrachys spp.) [Coleoptera: Chrysomelidae]

4534 Hydnocera discoidea LeConte [Coleoptera: Cleridae]

4535 Hyperaspis pleuralis aterrima Casey [Coleoptera: Coccinellidae]

4536 Dasytastes ruficollis (Ulke) [Coleoptera: Melyridae]

4537 Mordellistena aspersa Meish. [Coleoptera: Mordellidae]

4538 Euxesta nitidiventris Lw. [Diptera: Otitidae]

4539 Euxesta spp. [Diptera: Otitidae]

4540 Caliope variceps (Cog.) [Diptera: Lauxaniidae]

4541 Halictus sparsus Robt. [Hymenoptera: Halictidae]

4542 Crematogaster spp. [Hymenoptera: Formicidae]

4543 Myrmecocystus mexicanus navajo Wheeler [Hymenoptera: Formicidae]

4544 Myrmecocystus spp. [Hymenoptera: Formicidae]

4545 Deuterosminthurus spp. [Collembola: Sminthuridae]

4546 Anaphothrips spp. [Thysanoptera: Thripidae]

4547 Thrips spp. [Thysanoptera: Thripidae]

4548 Megalopsallus spp. [Hemiptera: Miridae]

4549 Psallus pictipes (Van Duzee) [Hemiptera: Miridae]

4550 Strongylocoris spp. [Hemiptera: Miridae]

4551 Ceratagallia dondia (Oman) [Homoptera: Cicadellidae]

4552 Neosteles neglectus (DeL. & D.) [Homoptera: Cicadellidae]

4553 Listus spp. [Coleoptera: Melyridae]

4554 Ethmiidae spp. [Lepidoptera: Ethmiidae]

4555 Madiza spp. [Diptera: Chloropidae]

4556 Chrysopilus spp. [Diptera: Rhagionidae]

4557 Eumacronychia spp. [Diptera: Sarcophagidae]

4558 Callimome spp. [Hymenoptera: Torymidae]

4559 Rileya spp. [Hymenoptera: Eurytomidae]

4560 Megalopsallus rubropictus Knight [Hemiptera: Miridae]

4561 Sthenarus humeralis Van Duzee [Hemiptera: Miridae]

4562 Pisema depressa McAtee [Hemiptera: Piesmatidae]

4563 Piesma explanata McAtee [Hemiptera: Piesmatidae]

4564 Sinea spp. [Hemiptera: Reduviidae]

4565 Saissetia nigra (Nietner) (Nigra scale) [Homoptera: Family?]

4566 Norvellina clarivada (Van Duzee) [Homoptera: Cicadellidae]

4567 Ophiola clavata (Ball) [Homoptera: Cicadellidae]

4568 Platypedia lutea Dan's. [Homoptera: Cicadellidae]

4569 Cryptorhopalum spp. [Coleoptera: Dermestidae]

4570 Mordellistena commata LeConte [Coleoptera: Mordellidae]

4571 Culicoides variipennis (Coquillett) [Diptera: Ceratopogonidae]

4572 Spaniotoma spp. [Diptera: Chironomidae]

4573 Scaptomyza graminum Fallen [Diptera: Drosophilidae]

4574 Plagia americana Coquillett [Diptera: Tachinidae]

4575 Zenillia spp. [Diptera: Tachinidae]

4576 Chalcaspis phenacocci Ashmead [Hymenoptera: Encyrtidae]

4577 Formica neogagates lasioides [Hymenoptera: Formicidae]

4578 Melanoplus complanatipes canonicus Scudder [Orthoptera: Acrididae]

4579 Corizus viridicatus Uhler [Hemiptera: Rhopalidae]

4580 Athysanus frigidus Ball [Homoptera: Cicadellidae]

4581 Empoasca nigra typhlocyboides G. & B. [Homoptera: Cicadellidae]

4582 Hippodamia spp. [Coleoptera: Coccinellidae]

4583 Promecotarsus densus Casey [Coleoptera: Curculionidae]

4584 Cyrtopogon spp. [Diptera: Asilidae]

4585 Iridomyrmex spp. [Hymenoptera: Formicidae]

4586 Caliothrips fasciatus (Pergande) [Thysanoptera: Thripidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

4587 Cuerna occidentalis Oman & Beamer [Homoptera: Cicadellidae] Immature/Adult Guild: Stem feeder/Stem feeder

4588 Scleroracus bullatus (Ball) [Homoptera: Cicadellidae] Immature/Adult Guild: Leaf feeder/Leaf feeder

4589 Stictocephala spp. [Homoptera: Membracidae]

4590 Ponometia sutrix (Grote) [Lepidoptera: Noctuidae] Immature/Adult Guild: Leaf feeder/?

4591 Epiblema sosana Kearfott [Lepidoptera: Olethreutidae] Immature/Adult Guild: Stem feeder/?

4592 Altica carinata Germar [Coleoptera: Chrysomelidae] Immature/Adult Guild: ?/Leaf feeder

4593 Aeoloplus turnbulli turnbulli (Thomas) [Orthoptera: Acrididae] Immature/Adult Guild: Leaf feeder/Leaf feeder

4594 Fenusa pusilla (Lepeletier) (Birch leafminer) [Hymenoptera: Tenthredinidae] Immature/Adult Guild: Leaf miner/? Generations Per Year: Several

4595 Scirtothrips citri (Moulton) [Thysanoptera: Thripidae]

4596 Scirtothrips solaris Bailey [Thysanoptera: Thripidae]

4597 Scirtothrips tehachapi Bailey [Thysanoptera: Thripidae]

4598 Trirhabda luteocincta (LeConte) [Coleoptera: Chrysomelidae]

4599 Trirhabda confusa Blake [Coleoptera: Chrysomelidae]

4600 Trirhabda labrata Fall [Coleoptera: Chrysomelidae]

4601 Anthophora spp. [Hymenoptera: Megachilidae]

4602 Osmia spp. [Hymenoptera: Megachilidae]

4603 Nomia spp. [Hymenoptera: Halictidae]

4604 Tegeticula spp. [Lepidoptera: Incurvariidae]

4605 Gertaeckeria spp. [Coleoptera: Curculionidae]

4606 Prodoxus marginatus Riley [Lepidoptera: Incurvariidae]

4607 Prodoxus cinereus Riley [Lepidoptera: Incurvariidae]

4608 Deoclana yuccasella Busck [Lepidoptera: Gelechiidae]

4609 Holocera gigantella Chambers [Lepidoptera: Blastobasidae]

4610 Sosipatra rileyella (Ragonot) [Lepidoptera: Pyralidae]

4611 Tritogenaphis kosacaudis Knowlton [Homoptera: Aphididae]

4612 Tritogenaphis escalantis Knowlton [Homoptera: Aphididae]

4613 Tritogenaphis ambrosiae (Thomas) [Homoptera: Aphididae]

4614 Tritogenaphis erigeronensis (Thomas) [Homoptera: Aphididae]

4615 Acyrthosiphon californica (Clarke) [Homoptera: Aphididae]

4616 Coccidomyia erii Felt [Diptera: Cecidomyiidae]

4617 Lasioptera diplaci Felt [Diptera: Cecidomyiidae]

4618 Asphondylia diplaci Felt [Diptera: Cecidomyiidae]

4619 Asphondylia enceliae Felt [Diptera: Cecidomyiidae]

4620 Trirhabda sericotrachyla Blake [Coleoptera: Chrysomelidae]

4621 Trirhabda geminata Horn [Coleoptera: Chrysomelidae]

4622 Disholcaspis chrysolepidis (Beutenm.) [Hymenoptera: Cynipidae]

4623 Andricus crystallinus Bassett [Hymenoptera: Cynipidae] Immature/Adult Guild: Gall former/?

4624 Periclistus piceus Fullaway [Hymenoptera: Cynipidae]

4625 Rhodites politus Ashmaed [Hymenoptera: Cynipidae]

4626 Rhodites bicolor (W. Harr.) [Hymenoptera: Cynipidae]

4627 Disholcaspis truckeensis (Ashmead) [Hymenoptera: Cynipidae]

4628 Andricus chrysolepidis Ashmead [Hymenoptera: Cynipidae]

4629 Andricus congregatus Ashmead [Hymenoptera: Cynipidae]

4630 Andricus pacificus Ashmead [Hymenoptera: Cynipidae]

4631 Andricus dasydactyli Ashmead [Hymenoptera: Cynipidae]

4632 Callirhytis lasia Ashmead [Hymenoptera: Cynipidae]

4633 Callirhytis quercussuttoni (Bass.) [Hymenoptera: Cynipidae]

4634 Callirhytis bakeri Kieff. [Hymenoptera: Cynipidae]

4635 Callirhytis rossi Kieff. [Hymenoptera: Cynipidae]

4636 Callirhytis guadaloupensis Fullaway [Hymenoptera: Cynipidae]

4637 Callirhytis sanctaeclarae Fullaway [Hymenoptera: Cynipidae]

4638 Anoplodera jacintata Linsley [Coleoptera: Cerambycidae]

4639 Olyca junctolineela (Hulst) [Lepidoptera: Pyralidae]

4640 Rhinomalus texanus Schaeffer [Coleoptera: Family?]

4641 Actenodes flexicaulis Schaeffer [Coleoptera: Buprestidae]

4642 Cymatodera obliquefasciata Schaeffer [Coleoptera: Cleridae]

4643 Tetranodes niveicollis Linell. [Coleoptera: Family?]

4644 Cryptocephalus quatuodecimpustulatus Suffrian [Coleoptera: Chrysomelidae]

4645 Bruchus julianus Horn [Coleoptera: Bruchidae]

4646 Stigmella aurella (Fabricius) [Lepidoptera: Nepticulidae]

4647 Stigmella splendidissimella (H.S.) [Lepidoptera: Nepticulidae]

4648 Frankliniella canadensis Morgan [Thysanoptera: Thripidae]

4649 Frankliniella claripennis Morgan [Thysanoptera: Thripidae]

4650 Frankliniella trehernei Morgan [Thysanoptera: Thripidae]

4651 Frankliniella yuccae Moulton [Thysanoptera: Thripidae]

4652 Mermiria texana Bruner [Orthoptera: Acrididae]

4653 Mermiria maculipennis maculipennis [Orthoptera: Acrididae]

4654 Empoasca fabae (Harris) [Homoptera: Cicadellidae]

4655 Clastoptera atrapicata [Homoptera: Cercopidae]

4656 Capitophorus rosarum (Walker) [Homoptera: Aphididae]

4657 Dasyneura gemmae Felt [Diptera: Cecidomyiidae]

4658 Mcateeana sexnotata (Van Duzee) [Homoptera: Cicadellidae]

4659 Typhlocyba melite McAtee [Homoptera: Cicadellidae]

4660 Empoa spinosa (Beamer) [Homoptera: Cicadellidae]

4661 Edwardsiana commissuralis (Stal) [Homoptera: Cicadellidae]

4662 Edwardsiana ariste (McAtee) [Homoptera: Cicadellidae]

4663 Edwardsiana euphrante (McAtee) [Homoptera: Cicadellidae]

4664 Macrosiphum rubiellum harpagorubus Knowlton [Homoptera: Aphididae]

4665 Myzus convolvuli (Kaltenbach) [Homoptera: Aphididae]

4666 Cerosipha rubifolii (Thomas) [Homoptera: Aphididae]

4667 Hermetia hunteri Cockerell [Diptera: Stratiomyidae]

4668 Chelinidea hunteri Hamlin [Hemiptera: Coreidae]

4669 Empoasca obtusa Walsh [Homoptera: Cicadellidae]

4670 Empoasca recurvata DeLong [Homoptera: Cicadellidae]

4671 Ethmia arctostaphylella (Walsingham) [Lepidoptera: Ethmiidae] Oviposition Medium: Leaf surfaces

4672 Ethmia semitenebrella Dyar [Lepidoptera: Ethmiidae]

4673 Gracilaria syringella Fabricius (Lilac leafminer or leafroller) [Lepidoptera: Gracilariidae] Immature/Adult Guild: Leaf miner,leaf roller/? Overwintering Stage: Larvae,pupae in soil,leaves Oviposition Medium: Leaf undersides Generations Per Year: 2-3

4674 Cylindromyia armata Ald. [Diptera: Tachinidae]

4675 Gymnosoma fuliginosa Des. [Diptera: Tachinidae]

4676 Phorocera claripennis Mcq. [Diptera: Tachinidae]

4677 Agromyza platyptera jucunda V.d.W. [Diptera: Agromyzidae]

4678 Agromyza reptans Fall [Diptera: Agromyzidae]

4679 Napomyza lateralis Fall [Diptera: Agromyzidae]

4680 Phytomyza albiceps Meig. [Diptera: Agromyzidae]

4681 Phytomyza chrysanthemi Kowarz [Diptera: Agromyzidae]

4682 Brachyrhinus spp. [Coleoptera: Curculionidae]

4683 Dyslobus spp. [Coleoptera: Curculionidae]

4684 Stegophylla quercicola (Baker)Oestlund [Homoptera: Aphididae]

4685 Megachile sidalceae Cockerell [Hymenoptera: Megachilidae]

4686 Chlorochroa congrua Uhler [Hemiptera: Pentatomidae]

4687 Euschistus inflatus Van Duzee [Hemiptera: Pentatomidae]

4688 Euschistus variolarius (Palisot & Beauvois) (Onespot stink bug) [Hemiptera: Pentatomidae]

4689 Eysarcoris intergressus Uhler [Hemiptera: Family?]

4690 Amphorophora nigricornis Knowlton [Homoptera: Aphididae]

4691 Amphorophora halli Knowlton [Homoptera: Aphididae]

4692 Rhynchites bicolor wickhami Cockerell (Western rose curculio) [Coleoptera: Curculionidae] Immature/Adult Guild: Bud feeder/Bud,leaf,stem feeder Overwintering Stage: Larvae Oviposition Medium: Bud punctures Generations Per Year: 1

4693 Brevicoryne salixutis Smith & Knowlton [Homoptera: Aphididae]

4694 Stobaera bilobata Van Duzee [Homoptera: Delphacidae]

4695 Stobaera giffardi Van Duzee [Homoptera: Delphacidae]

4696 Deraeocoris navajo Knight [Hemiptera: Miridae]

4697 Lygus robustus (Uhler) [Hemiptera: Miridae]

4698 Misa cosyra (Druce) [Lepidoptera: Noctuidae]

4699 Raphia frater Grote [Lepidoptera: Noctuidae]

4700 Charadra deridens (Gn.) [Lepidoptera: Noctuidae]

4701 Acronycta leporina (Linnaeus) [Lepidoptera: Noctuidae]

4702 Acronycta dactylina (Grote) [Lepidoptera: Noctuidae]

4703 Acronycta interrupta Gn. [Lepidoptera: Noctuidae]

4704 Acronycta grisea Walker [Lepidoptera: Noctuidae]

4705 Acronycta impleta Walker [Lepidoptera: Noctuidae]

4706 Acronycta distans (Grote) [Lepidoptera: Noctuidae]

4707 Acronycta perdita Grote [Lepidoptera: Noctuidae]

4708 Acronycta impressa Walker [Lepidoptera: Noctuidae]

4709 Acronycta barnesi Sm. [Lepidoptera: Noctuidae]

4710 Acronycta lanceolaria (Grote) [Lepidoptera: Noctuidae]

4711 Simyra henrici (Grote) [Lepidoptera: Noctuidae]

4712 Schinia marginata Haw. [Lepidoptera: Noctuidae]

4713 Schinia thoreaui G. & R. [Lepidoptera: Noctuidae]

4714 Dasyspoudaea lucens (Morrison) [Lepidoptera: Noctuidae]

4715 Canthylidia scutosa (Denis & Schiff.) [Lepidoptera: Noctuidae]

4716 Oxycnemis spp. Grote [Lepidoptera: Noctuidae]

4717 Lathosea spp. Grote [Lepidoptera: Noctuidae]

4718 Lathosea dammersi McD. [Lepidoptera: Noctuidae]

4719 Cucullia laetifica Lint. [Lepidoptera: Noctuidae]

4720 Feralia februalis Grote [Lepidoptera: Noctuidae]

4721 Homohadena stabilis Sm. [Lepidoptera: Noctuidae]

4722 Oncocnemis spp. Led. [Lepidoptera: Noctuidae]

4723 Marathyssa inficita (Walker) [Lepidoptera: Noctuidae]

4724 Hemieuxoa rudens (Harv.) [Lepidoptera: Noctuidae]

4725 Spaelotis havilae (Grote) [Lepidoptera: Noctuidae]

4726 Pseudospaelotis haruspica (Grote) [Lepidoptera: Noctuidae]

4727 Setagrotis planifrons (Sm.) [Lepidoptera: Noctuidae]

4728 Setagrotis piscipellis (Grote) [Lepidoptera: Noctuidae]

4729 Eurois occulta (Linnaeus) [Lepidoptera: Noctuidae]

4730 Eurois astricta Morrison [Lepidoptera: Noctuidae]

4731 Anomogyna infimatis (Grote) [Lepidoptera: Noctuidae]

4732 Graphiphora smithi (Snell.) [Lepidoptera: Noctuidae]

4733 Graphiphora normaniana (Grote) [Lepidoptera: Noctuidae]

4734 Protolampra brunneicollis (Grote) [Lepidoptera: Noctuidae]

4735 Anaplectoides prasina (Denis & Schiff.) [Lepidoptera: Noctuidae]

4736 Hemigraphiphora plebeia (Sm.) [Lepidoptera: Noctuidae]

4737 Protolampra rufipectus (Morrison) [Lepidoptera: Noctuidae]

4738 Abagrotis erratica (Sm.) [Lepidoptera: Noctuidae]

4739 Rhynchagrotis cupida (Grote) [Lepidoptera: Noctuidae]

4740 Abagrotis nanalis (Grote) [Lepidoptera: Noctuidae]

4741 Abagrotis forbesi (Benj.) [Lepidoptera: Noctuidae]

4742 Abagrotis discoidalis (Grote) [Lepidoptera: Noctuidae]

4743 Abagrotis nefascia (Sm.) [Lepidoptera: Noctuidae]

4744 Abagrotis barnesi (Benj.) [Lepidoptera: Noctuidae]

4745 Abagrotis spp. [Lepidoptera: Noctuidae]

4746 Abagrotis apposita (Grote) [Lepidoptera: Noctuidae]

4747 Protorthodes curtica (Sm.) [Lepidoptera: Noctuidae]

4748 Lacinipolia patalis (Grote) [Lepidoptera: Noctuidae]

4749 Lacinipolia pensilis (Grote) [Lepidoptera: Noctuidae]

4750 Lacinipolia stricta (Walker) [Lepidoptera: Noctuidae]

4751 Lacinipolia quadrilineata (Grote) [Lepidoptera: Noctuidae]

4752 Lasionycta perplexa (Sm.) [Lepidoptera: Noctuidae]

4753 Polia detracta (Walker) [Lepidoptera: Noctuidae]

4754 Miodera stigmata Sm. [Lepidoptera: Noctuidae]

4755 Zosteropoda hirtipes Grote [Lepidoptera: Noctuidae]

4756 Orthodes crenulata (Butl.) [Lepidoptera: Noctuidae]

4757 Pseudorthodes irrorata (Sm.) [Lepidoptera: Noctuidae]

4758 Lophoceramica artega (Barnes) [Lepidoptera: Noctuidae]

4759 Homorthodes communis (Dyar) [Lepidoptera: Noctuidae]

4760 Protorthodes texana (Sm.) [Lepidoptera: Noctuidae]

4761 Homorthodes perbrunnea (Grote) [Lepidoptera: Noctuidae]

4762 Polia delecta B. & McD. [Lepidoptera: Noctuidae]

4763 Stretchia muricina (Grote) [Lepidoptera: Noctuidae]

4764 Polia nugatis (Sm.) [Lepidoptera: Noctuidae]

4765 Polia pulverulenta (Sm.) [Lepidoptera: Noctuidae]

4766 Polia grandis (Boisduvall) [Lepidoptera: Noctuidae]

4767 Polia nimbosa (Gn.) [Lepidoptera: Noctuidae]

4768 Polia invalida (Sm.) [Lepidoptera: Noctuidae]

4769 Polia adjuncta (Boisduvall) [Lepidoptera: Noctuidae]

4770 Polia subjuncta (G. & R.) [Lepidoptera: Noctuidae]

4771 Polia lutra (Gn.) [Lepidoptera: Noctuidae]

4772 Polia atlantica (Grote) [Lepidoptera: Noctuidae]

4773 Xylomania crucialis (Harv.) [Lepidoptera: Noctuidae]

4774 Xylomania spp. Hamp. [Lepidoptera: Noctuidae]

4775 Xylomania hiemalis (Grote) [Lepidoptera: Noctuidae]

4776 Orthosia praeses (Grote) [Lepidoptera: Noctuidae]

4777 Acerra normalis (Grote) [Lepidoptera: Noctuidae]

4778 Xylomyges rubrica (Harv.) [Lepidoptera: Noctuidae]

4779 Ufeus hulsti Sm. [Lepidoptera: Noctuidae]

4780 Ufeus faunus Stkr. [Lepidoptera: Noctuidae]

4781 Andropolia diversilineata (Grote) [Lepidoptera: Noctuidae]

4782 Lithomoia solidaginis (Hubner) [Lepidoptera: Noctuidae]

4783 Xylena brucei (Sm.) [Lepidoptera: Noctuidae]

4784 Xylena nupera (Lint.) [Lepidoptera: Noctuidae]

4785 Xylena curvimacula (Morrison) [Lepidoptera: Noctuidae]

4786 Pseudoglaea olivata (Harv.) [Lepidoptera: Noctuidae]

4787 Platypolia contadina (Sm.) [Lepidoptera: Noctuidae]

4788 Hillia maida (Dyar) [Lepidoptera: Noctuidae]

4789 Fishia evelina (French) [Lepidoptera: Noctuidae]

4790 Fishia yosemitae (Grote) [Lepidoptera: Noctuidae]

4791 Graptolitha dilatocula (Sm.) [Lepidoptera: Noctuidae]

4792 Lithophane georgii Grote [Lepidoptera: Noctuidae]

4793 Lithophane antennata (Walker) [Lepidoptera: Noctuidae]

4794 Lithophane unimoda (Lint.) [Lepidoptera: Noctuidae]

4795 Homohadena fifia Dyar [Lepidoptera: Noctuidae]

4796 Tricholita chipeta Barnes [Lepidoptera: Noctuidae]

4797 Stretchia plusiaeformis Hy. Edw. [Lepidoptera: Noctuidae]

4798 Lithophane pertorrida (McD.) [Lepidoptera: Noctuidae]

4799 Lithophane disposita Morrison [Lepidoptera: Noctuidae]

4800 Lithophane innominata (Sm.) [Lepidoptera: Noctuidae]

4801 Eupsilia tristigmata (Grote) [Lepidoptera: Noctuidae]

4802 Eupsilia fringata (B. & McD.) [Lepidoptera: Noctuidae]

4803 Eupsilia devia (Grote) [Lepidoptera: Noctuidae]

4804 Litholomia napaea (Morrison) [Lepidoptera: Noctuidae]

4805 Brachylomia populi (Stkr.) [Lepidoptera: Noctuidae]

4806 Hyppa brunneicrista Sm. [Lepidoptera: Noctuidae]

4807 Euplexia benesimilis McD. [Lepidoptera: Noctuidae]

4808 Zotheca tranquilla Grote [Lepidoptera: Noctuidae]

4809 Aseptis characta (Grote) [Lepidoptera: Noctuidae]

4810 Aseptis fumeola (Hamp.) [Lepidoptera: Noctuidae]

4811 Aseptis perfumosa (Hamp.) [Lepidoptera: Noctuidae]

4812 Aseptis binotata (Walker) [Lepidoptera: Noctuidae]

4813 Ogdoconta cinereola (Gn.) [Lepidoptera: Noctuidae]

4814 Platysenta discistriga (Sm.) [Lepidoptera: Noctuidae]

4815 Platysenta spp. Grote [Lepidoptera: Noctuidae]

4816 Plagiomimicus pityochromus Grote [Lepidoptera: Noctuidae]

4817 Sunira verberata (Sm.) [Lepidoptera: Noctuidae]

4818 Sunira straminea (Sm.) [Lepidoptera: Noctuidae]

4819 Xanthia lutea (Strom.) [Lepidoptera: Noctuidae]

4820 Amphipyra pyramidoides Gn. [Lepidoptera: Noctuidae]

4821 Papaipema pertincta Dyar [Lepidoptera: Noctuidae]

4822 Plusia aereoides Grote [Lepidoptera: Noctuidae]

4823 Syngrapha orophila (Hamp.) [Lepidoptera: Noctuidae]

4824 Autographa ampla Walker [Lepidoptera: Noctuidae]

4825 Autographa corusca (Stkr.) [Lepidoptera: Noctuidae]

4826 Sarrothripus frigidana (Walker) [Lepidoptera: Noctuidae]

4827 Characoma nilotica (Rogenh.) [Lepidoptera: Noctuidae]

4828 Synedoida divergens (Behr.) [Lepidoptera: Noctuidae]

4829 Drasteria mirifica (Hy. Edw.) [Lepidoptera: Noctuidae]

4830 Synedoida howlandi (Grote) [Lepidoptera: Noctuidae]

4831 Bulia deducta (Morrison) [Lepidoptera: Noctuidae]

4832 Melipotis novanda (Gn.) [Lepidoptera: Noctuidae]

4833 Melipotis jucunda Hubner [Lepidoptera: Noctuidae]

4834 Zaleops umbrina (Grote) [Lepidoptera: Noctuidae]

4835 Yrias volucris (Grote) [Lepidoptera: Noctuidae]

4836 Yrias crudelis Grote [Lepidoptera: Noctuidae]

4837 Yrias repentis (Grote) [Lepidoptera: Noctuidae]

4838 Heteranassa mima (Harv.) [Lepidoptera: Noctuidae]

4839 Otosema odora (L.) [Lepidoptera: Noctuidae]

4840 Zale lunata (Drury) [Lepidoptera: Noctuidae]

4841 Zale minerea (Gn.) [Lepidoptera: Noctuidae]

4842 Toxocampa victoria Grote [Lepidoptera: Noctuidae]

4843 Catocala relicta Walker [Lepidoptera: Noctuidae]

4844 Catocala amatrix (Hubner) [Lepidoptera: Noctuidae]

4845 Catocala unijuga Walker [Lepidoptera: Noctuidae]

4846 Catocala luciana Stkr. [Lepidoptera: Noctuidae]

4847 Catocala allusa Hlst. [Lepidoptera: Noctuidae]

4848 Catocala irene Behr. [Lepidoptera: Noctuidae]

4849 Catacala babayaga Stkr. [Lepidoptera: Noctuidae]

4850 Catocala arizonae Grote [Lepidoptera: Noctuidae]

4851 Catocala hermia Hy. Edw. [Lepidoptera: Noctuidae]

4852 Catocala chelidonia Grote [Lepidoptera: Noctuidae]

4853 Catocala gracilis Edw. [Lepidoptera: Noctuidae]

4854 Scoliopteryx libatrix (L.) [Lepidoptera: Noctuidae]

4855 Palthis angulalis Hubner [Lepidoptera: Noctuidae]

4856 Zale rubi (Hy. Edw.) [Lepidoptera: Noctuidae]

4857 Phlogophora periculosa Gn. [Lepidoptera: Noctuidae]

4858 Lycanades pulchella (Grote) [Lepidoptera: Noctuidae]

4859 Tischeria ceanothi Walsingham [Lepidoptera: Tischeriidae]
Immature/Adult Guild: Leaf miner/?

4860 Tischeria ambigua Braun [Lepidoptera: Tischeriidae]
Immature/Adult Guild: Leaf miner/?

4861 Tischeria bifurcata Braun [Lepidoptera: Tischeriidae]
Immature/Adult Guild: Leaf miner/?

4862 Pulvinaria innumerablis (Cottony maple scale) [Homoptera: Coccidae]
Oviposition Medium: Twig surfaces

4863 Rhopalomyzus grabhami (Cockerell) [Homoptera: Aphididae]

4864 Sitobion frageriae Walker [Homoptera: Aphididae]

4865 Stegophylla essigi H.R. Lambers [Homoptera: Aphididae]

4866 Braggia deserticola H.R. Lambers [Homoptera: Aphididae]

4867 Braggia eriogoni (Cowen) [Homoptera: Aphididae]

4868 Braggia urovaneta (Hottes) [Homoptera: Aphididae]

4869 Euthoracaphis umbellulariae (Essig) [Homoptera: Aphididae]

4870 Fimbriaphis gentneri (Mason) [Homoptera: Aphididae]

4871 Glabromyzus schlingeri H.R. Lambers [Homoptera: Aphididae]

4872 Macrosiphum raysmithi H.R. Lambers [Homoptera: Aphididae]

4873 Pleotrichophorus obscuratus H.R. Lambers [Homoptera: Aphididae]

4874 Papilio dardanus [Lepidoptera: Papilionidae]

4875 Papilio glaucus [Lepidoptera: Papilionidae]

4876 Papilio spp. [Lepidoptera: Papilionidae]

4877 Gonepteryx spp. [Lepidoptera: Family?]

4878 Acanthoscelides daleae Johnson [Coleoptera: Bruchidae]

4879 Caupolicana yarrowi (Cresson) [Hymenoptera: Colletidae]

4880 Ptiloglossa arizonensis Timberlake [Hymenoptera: Colletidae]

4881 Ptiloglossa jonesi Timberlake [Hymenoptera: Colletidae]

4882 Colletes clypeonitens Swenk [Hymenoptera: Colletidae]

4883 Colletes covilleae Timberlake [Hymenoptera: Colletidae]

4884 Colletes larreae Timberlake [Hymenoptera: Colletidae]

4885 Colletes louisae Cockerell [Hymenoptera: Colletidae]

4886 Colletes stepheni Cockerell [Hymenoptera: Colletidae]

4887 Colletes wootoni Cockerell [Hymenoptera: Colletidae]

4888 Ancylandrena larreae Timberlake [Hymenoptera: Andrenidae]

4889 Megandrena enceliae Cockerell [Hymenoptera: Andrenidae]

4890 Perdita flavipes Timberlake [Hymenoptera: Andrenidae]

4891 Perdita covilleae Timberlake [Hymenoptera: Andrenidae]

4892 Perdita punctulata Timberlake [Hymenoptera: Andrenidae]

4893 Perdita semiaerulea Cockerell [Hymenoptera: Andrenidae]

4894 Perdita eremica Timberlake [Hymenoptera: Andrenidae]

4895 Perdita luciae decora Timberlake [Hymenoptera: Andrenidae]

4896 Perdita lateralis lateralis Timberlake [Hymenoptera: Andrenidae]

4897 Perdita larreae Cockerell [Hymenoptera: Andrenidae]

4898 Perdita marcialis Cockerell [Hymenoptera: Andrenidae]

4899 Perdita turgiceps Timberlake [Hymenoptera: Andrenidae]

4900 Nomadopsis foleyi Timberlake [Hymenoptera: Andrenidae]

4901 Nomadopsis larreae Timberlake [Hymenoptera: Andrenidae]

4902 Protoxaea gloriosa (Fox) [Hymenoptera: Oxaeidae]

4903 Lasioglossum sisymbrii (Cockerell) [Hymenoptera: Halictidae]

4904 Evylaeus amicus (Cockerell) [Hymenoptera: Halictidae]

4905 Dialictus alius (Sandhouse) [Hymenoptera: Halictidae]

4906 Dialictus clarissimus (Ellis) [Hymenoptera: Halictidae]

4907 Dialictus microlepoides (Ellis) [Hymenoptera: Halictidae]

4908 Dialictus perparvum (Ellis) [Hymenoptera: Halictidae]

4909 Dialictus pruinisiformis (Crawford) [Hymenoptera: Halictidae]

4910 Agapostemon angelicus Cockerell [Hymenoptera: Halictidae]

4911 Agapostemon cockerelli Crawford [Hymenoptera: Halictidae]

4912 Agapostemon tyleri Cockerell [Hymenoptera: Halictidae]

4913 Nomia mesillensis Cockerell [Hymenoptera: Halictidae]

4914 Nomia tetrazonata tetrazonata Cockerell [Hymenoptera: Halictidae]

4915 Hesperapis arida Michener [Hymenoptera: Melittidae]

4916 Hesperapis larreae Cockerell [Hymenoptera: Melittidae]

4917 Heteranthidium larreae (Cockerell) [Hymenoptera: Megachilidae]

4918 Anthidium cockerelli Schwarz [Hymenoptera: Megachilidae]

4919 Anthidium jocosum Cresson [Hymenoptera: Megachilidae]

4920 Anthidium paroselae Cockerell [Hymenoptera: Megachilidae]

4921 Anthidium sonorense Cockerell [Hymenoptera: Megachilidae]

4922 Anthidiellum ehrhorni (Cockerell) [Hymenoptera: Megachilidae]

4923 Ashmeadiella breviceps Michener [Hymenoptera: Megachilidae]

4924 Hoplitis biscutellae (Cockerell) [Hymenoptera: Megachilidae]

4925 Osmia clarescens Cockerell [Hymenoptera: Megachilidae]

4926 Osmia marginata Michener [Hymenoptera: Megachilidae]

4927 Osmia titusi Cockerell [Hymenoptera: Megachilidae]

4928 Megachile gentilis Cresson [Hymenoptera: Megachilidae]

4929 Megachile lippiae Cockerell [Hymenoptera: Megachilidae]

4930 Megachile fucata Cockerell [Hymenoptera: Megachilidae]

4931 Megachile policaris Say [Hymenoptera: Megachilidae]

4932 Chalicodoma chilopsidis (Cockerell) [Hymenoptera: Megachilidae]

4933 Chalicodoma discorhina (Cockerell) [Hymenoptera: Megachilidae]

4934 Chalicodoma occidentalis (Fox) [Hymenoptera: Megachilidae]

4935 Chalicodoma spinotulata (Mitchell) [Hymenoptera: Megachilidae]

4936 Exomalopsis solani Cockerell [Hymenoptera: Anthophoridae]

4937 Martinapis luteicornis (Cockerell) [Hymenoptera: Anthophoridae]

4938 Melissodes paroselae Cockerell [Hymenoptera: Anthophoridae]

4939 Melissodes tristis Cockerell [Hymenoptera: Anthophoridae]

4940 Xenoglossodes eriocarpi (Cockerell) [Hymenoptera: Anthophoridae]

4941 Synhalonia albescens Timberlake [Hymenoptera: Anthophoridae]

4942 Synhalonia angustifrons Timberlake [Hymenoptera: Anthophoridae]

4943 Synhalonia primiveris Timberlake [Hymenoptera: Anthophoridae]

4944 Synhalonia venusta venusta (Timberlake) [Hymenoptera: Anthophoridae]

4945 Anthophora linsleyi Timberlake [Hymenoptera: Anthophoridae]

4946 Anthophora urbana urbana Cresson [Hymenoptera: Anthophoridae]

4947 Anthophora californica albomarginata Timberlake [Hymenoptera: Anthophoridae]

4948 Anthophora hololeuca Cockerell [Hymenoptera: Anthophoridae]

4949 Emphoropsis pallida Timberlake [Hymenoptera: Anthophoridae]

4950 Centris hoffmanseggiae Cockerell [Hymenoptera: Anthophoridae]

4951 Centris pallida Fox [Hymenoptera: Anthophoridae]

4952 Centris atripes Mocsary [Hymenoptera: Anthophoridae]

4953 Centris cockerelli resoluta Cockerell [Hymenoptera: Anthophoridae]

4954 Centris rhodopus Cockerell [Hymenoptera: Anthophoridae]

4955 Ceratina apacheorum Daly [Hymenoptera: Anthophoridae]

4956 Xylocopa californica arizonensis Cresson [Hymenoptera: Anthophoridae]

4957 Xylocopa tabaniformis androleuca Michener [Hymenoptera: Anthophoridae]

4958 Bombus pennsylvanicus sonorus Say [Hymenoptera: Apidae]

4959 Multareoides digitatus (Van Duzee) [Homoptera: Membracidae]

4960 Multareoides planifrons (Van Duzee) [Homoptera: Membracidae]

4961 Callosobruchus maculatus (Fabricius) [Coleoptera: Bruchidae] Immature/Adult Guild: Internal seed feeder/?
Oviposition Medium: Seed surfaces

4962 Adelphocoris lineolatus [Hemiptera: Miridae]

4963 Orthezia juniperi Morrison [Homoptera: Ortheziidae]

4964 Arctorthezia pseudoccidentalis Morrison [Homoptera: Ortheziidae]

4965 Asterolecanium agavis (Russell) [Homoptera: Coccidae]

4966 Asterolecanium grandiculum (Russell) [Homoptera: Coccidae]

4967 Aphis incognita H. & F. [Homoptera: Aphididae]

4968 Plagiomerus diaspidis Crawford [Hymenoptera: Encyrtidae] Immature/Adult Guild: Endoparasite/?

4969 Microsiphum oregonensis Wilson [Homoptera: Aphididae]

4970 Lachnus edulis Wilson [Homoptera: Aphididae]

4971 Lachnus burrilli Wilson [Homoptera: Aphididae]

4972 Tuberolachnus viminalis (Boyer) [Homoptera: Aphididae]

4973 Chrysobothris prosopidis Fisher [Coleoptera: Buprestidae]

4974 Chrysobothris cuprascens LeConte [Coleoptera: Buprestidae]

4975 Chrysobothris helferi Fisher [Coleoptera: Buprestidae]

4976 Chrysobothris speculifer Horn [Coleoptera: Buprestidae]

4977 Chrysobothris iris Van Dyke [Coleoptera: Buprestidae]

4978 Chrysobothris viridicyanea Horn [Coleoptera: Buprestidae]

4979 Chrysobothris carmelita Fall [Coleoptera: Buprestidae]

4980 Chrysobothris piuta Wickham [Coleoptera: Buprestidae]

4981 Actenodes mendax Horn [Coleoptera: Buprestidae]

4982 Chrysobothris arizonica Chamberlain [Coleoptera: Buprestidae]

4983 Chrysobothris chamberlini Fisher [Coleoptera: Buprestidae]

4984 Chrysobothris deserta Horn [Coleoptera: Buprestidae]

4985 Chrysobothris atriplexae Fisher [Coleoptera: Buprestidae]

4986 Chrysobothris pubescens Fall [Coleoptera: Buprestidae]

4987 Chrysobothris beyeri Schaeffer [Coleoptera: Buprestidae]

4988 Chrysobothris aeneola LeConte [Coleoptera: Buprestidae]

4989 Chrysobothris humulus Horn [Coleoptera: Buprestidae]

4990 Chrysobothris purpureoplagiata Schaeffer [Coleoptera: Buprestidae]

4991 Chrysobothris lilaceous Chamberlain [Coleoptera: Buprestidae]

4992 Chrysobothris juniperus Chamberlain [Coleoptera: Buprestidae]

4993 Chrysobothris quadrilineata LeConte [Coleoptera: Buprestidae]

4994 Chrysobothris nixa Horn [Coleoptera: Buprestidae]

4995 Chrysobothris acuminata LeConte [Coleoptera: Buprestidae]

4996 Chrysobothris serripes Schaeffer [Coleoptera: Buprestidae]

4997 Chrysobothris atrifasciata LeConte [Coleoptera: Buprestidae]

4998 Chrysobothris platti Cazier [Coleoptera: Buprestidae]

4999 Melissodes pallidicincta Cockerell [Hymenoptera: Anthophoridae]

5000 Chlosyne lacinia (Geyer) [Lepidoptera: Nymphalidae]

5001 Polygonia comma (Harris) [Lepidoptera: Nymphalidae]

5002 Limenitis weidemeyerii W.H. Edwards [Lepidoptera: Nymphalidae]

5003 Zerene cesonia (Stoll) [Lepidoptera: Pieridae]

5004 Incisalia augustinus (Westwood) [Lepidoptera: Lycaenidae]

5005 Incisalia polios Cook & Watson [Lepidoptera: Lycaenidae]

5006 Heteropsis alpheus (W.H.Edwards) [Lepidoptera: Hesperiidae]

5007 Heteropsis gracielae (MacNeil) [Lepidoptera: Hesperiidae]

5008 Calephelis nemesis (W.H. Edwards) [Lepidoptera: Riodinidae]

5009 Limenitis arthemis (Drury) [Lepidoptera: Nymphalidae]

5010 Polygonia faunus (W.H. Edwards) [Lepidoptera: Nymphalidae]

5011 Polygonia progne (Cramer) [Lepidoptera: Nymphalidae]

5012 Anteos clorinde (Godart) [Lepidoptera: Pieridae]

5013 Abaeis nicippe (Cramer) [Lepidoptera: Pieridae]

5014 Eurema mexicana (Boisduval) [Lepidoptera: Pieridae]

5015 Phoebis sennae (Linnaeus) [Lepidoptera: Pieridae]

5016 Pyrisitia lisa (Boisduvall & LeConte) [Lepidoptera: Pieridae]

5017 Phoebis philea (Johanson) [Lepidoptera: Pieridae]

5018 Papilio indra W.H. Edwards [Lepidoptera: Papilionidae]

5019 Apodemia nais (W.H. Edwards) [Lepidoptera: Riodinidae]

5020 Satyrium saepium (Boisduval) [Lepidoptera: Lycaenidae]

5021 Celastrina argiolus cinerea (W.H. Edwards) [Lepidoptera: Lycaenidae]

5022 Erynnis martialis (Scudder) [Lepidoptera: Hesperiidae]

5023 Erynnis pacuvius Lintner [Lepidoptera: Hesperiidae]

5024 Satyrium californica (W.H. Edwards) [Lepidoptera: Lycaenidae]

5025 Asterocampa celtis (Boisduvall & LeConte) [Lepidoptera: Nymphalidae]

5026 Asterocampa clyton (Boisduvall & LeConte) [Lepidoptera: Nymphalidae]

5027 Libytheana bachmanii (Kirtland) [Lepidoptera: Nymphalidae]

5028 Polygonia interrogationis (Fabricius) [Lepidoptera: Nymphalidae]

5029 Callipsyche behrii (W.H. Edwards) [Lepidoptera: Lycaenidae]

5030 Charidryas acastus (W.H. Edwards) [Lepidoptera: Nymphalidae]

5031 Charidryas palla (Boisduval) [Lepidoptera: Nymphalidae]

5032 Incisalia fotis (Strecker) [Lepidoptera: Lycaenidae]

5033 Limenitis lorquini (Boisduval) [Lepidoptera: Nymphalidae]

5034 Satyrium liparops (LeConte) [Lepidoptera: Lycaenidae]

5035 Clossiana frigga (Thunberg) [Lepidoptera: Nymphalidae]

5036 Clossiana alberta (W.H. Edwards) [Lepidoptera: Nymphalidae]

5037 Apodemia mormo Felder & Felder [Lepidoptera: Riodinidae]

5038 Euphilotes battoides ellisi (Shields) [Lepidoptera: Lycaenidae]

5039 Euphilotes rita coloradensis (Matoni) [Lepidoptera: Lycaenidae]

5040 Euphilotes battoides centralis (Barnes & McDunnough) [Lepidoptera: Lycaenidae]

5041 Euphilotes rita pallescens (Tilden & Downey) [Lepidoptera: Lycaenidae]

5042 Euphilotes rita emmeli (Shields) [Lepidoptera: Lycaenidae]

5043 Euphilotes spaldingi (Barnes & McDunnough) [Lepidoptera: Lycaenidae]

5044 Chalceria heteronea (Boisduval) [Lepidoptera: Lycaenidae]

5045 Callophrys affinis (W.H. Edwards) [Lepidoptera: Lycaenidae]

5046 Callophrys apama (W.H. Edwards) [Lepidoptera: Lycaenidae]

5047 Callophrys comstocki Henne [Lepidoptera: Lycaenidae]

5048 Callophrys sheridanii (W.H. Edwards) [Lepidoptera: Lycaenidae]

5049 Euphilotes battoides glaucon (W.H. Edwards) [Lepidoptera: Lycaenidae]

5050 Euphilotes enoptes ancilla (Barnes & McDunnough) [Lepidoptera: Lycaenidae]

5051 Colias peldine Boisduvall & LeConte [Lepidoptera: Pieridae]

5052 Plebejus acmon (Westwood & Hewitson) [Lepidoptera: Lycaenidae]

5053 Mitoura siva (W.H. Edwards) [Lepidoptera: Lycaenidae]

5054 Phyciodes phaon (W.H. Edwards) [Lepidoptera: Nymphalidae]

5055 Junonia coenia (Hubner) [Lepidoptera: Nymphalidae]

5056 Hypodryas gillettii (Barnes) [Lepidoptera: Nymphalidae]

5057 Glaucopsyche piasus daunia (W.H. Edwards) [Lepidoptera: Lycaenidae]

5058 Lycaeides argyrognomon sublivens Nabokov [Lepidoptera: Lycaenidae]

5059 Colias philodoce Godart [Lepidoptera: Pieridae]

5060 Erynnis afranius (Lintner) [Lepidoptera: Hesperiidae]

5061 Glaucopsyche piasus (Boisduvall) [Lepidoptera: Lycaenidae]

5062 Lycaeides argyrognomon (Bergstrasser) [Lepidoptera: Lycaenidae]

5063 Lycaeides melissa (W.H. Edwards) [Lepidoptera: Lycaenidae]

5064 Plebejus shasta (W.H. Edwards) [Lepidoptera: Lycaenidae]

5065 Satyrium fuliginosum (W.H. Edwards) [Lepidoptera: Lycaenidae]

5066 Vanessa annabella (Field) [Lepidoptera: Nymphalidae]

5067 Ministrymon leda (W.H. Edwards) [Lepidoptera: Lycaenidae]

5068 Apodemia palmerii (W.H. Edwards) [Lepidoptera: Riodinidae]

5069 Hemiargus ceraunus Fabricius [Lepidoptera: Lycaenidae]

5070 Euphoeades eurymedon (Lucas) [Lepidoptera: Papilionidae]

5071 Euphoeades glaucus (Linnaeus) [Lepidoptera: Papilionidae]

5072 Euphoeades multicaudatus (Kirby) [Lepidoptera: Papilionidae]

5073 Euphoeades rutulus (Lucas) [Lepidoptera: Papilionidae]

5074 Harkenclenus titus (Fabricius) [Lepidoptera: Lycaenidae]

5075 Limenitis archippus (Cramer) [Lepidoptera: Nymphalidae]

5076 Heraclides cresphontes (Cramer) [Lepidoptera: Papilionidae]

5077 Habrodais grunus (Boisduval) [Lepidoptera: Lycaenidae]

5078 Erynnis brizo burgessi (Skinner) [Lepidoptera: Hesperiidae]

5079 Erynnis horatius (Scudder & Burgess) [Lepidoptera: Hesperiidae]

5080 Erynnis telemachus Burns [Lepidoptera: Hesperiidae]

5081 Hapaurotis crysalus (W.H. Edwards) [Lepidoptera: Lycaenidae]

5082 Satyrium calanus (Hubner) [Lepidoptera: Lycaenidae]

5083 Polygonia oreas oreas (W.H. Edwards) [Lepidoptera: Papilionidae]

5084 Tharsalea arota (Boisduval) (Arota) [Lepidoptera: Lycaenidae]

5085 Clossiana freija (Thunberg) [Lepidoptera: Nymphalidae]

5086 Satyrium acadica (W.H. Edwards) [Lepidoptera: Lycaenidae]

5087 Satyrium sylvinus (Boisduval) [Lepidoptera: Lycaenidae]

5088 Clossiana acrocnema (Gall & Sperling) [Lepidoptera: Nymphalidae]

5089 Colias gigantea Strecker [Lepidoptera: Pieridae]

5090 Colias scudderii Reakirt [Lepidoptera: Pieridae]

5091 Erynnis icelus (Scudder & Burgess) [Lepidoptera: Hesperiidae]

5092 Nymphalis vaualbum (Denis & Schiffermul.) [Lepidoptera: Nymphalidae]

5093 Proclossiana eunomia (Esper) [Lepidoptera: Nymphalidae]

5094 Occidryas chalcedona paradoxa (McDunnough) [Lepidoptera: Nymphalidae]

5095 Colias interior Scudder [Lepidoptera: Pieridae]

5096 Megathymus streckeri streckeri [Lepidoptera: Hesperiidae]

5097 Megathymus coloradensis navajo Skinner [Lepidoptera: Hesperiidae]

5098 Megathymus streckeri texanus [Lepidoptera: Hesperiidae]

5099 Megathymus coloradensis Riley [Lepidoptera: Hesperiidae]

5100 Megathymus streckeri (Skinner) [Lepidoptera: Hesperiidae]

5101 Megathymus coloradensis browni [Lepidoptera: Hesperiidae]

5102 Lestes unguiculatus Hagen [Odonata: Lestidae]

5103 Amphiagrion abbreviatum (Selys) [Odonata: Coenagrionidae]

5104 Enallagma boreale Selys [Odonata: Coenagrionidae]

5105 Trimerotropis arenacea Rehn [Orthoptera: Acrididae]

5106 Trimerotropis cyaneipennis Brunner [Orthoptera: Acrididae]

5107 Oedaleothrips yosemitae (Moulton) [Thysanoptera: Phlaeothripidae]

5108 Deraeocoris nubilus Knight [Hemiptera: Miridae]

5109 Deraeocoris schwartzii (Uhler) [Hemiptera: Miridae]

5110 Dicyphus cucurbitaceus (Spinola) [Hemiptera: Miridae]

5111 Hadronema militare (Uhler) [Hemiptera: Miridae]

5112 Hadronema simplex Knight [Hemiptera: Miridae]

5113 Labopidea spp. [Hemiptera: Miridae]

5114 Dichroascytus irroratus Van Duzee [Hemiptera: Miridae]

5115 Lygus desertus Knight [Hemiptera: Miridae]

5116 Lygus nigropallidus Knight [Hemiptera: Miridae]

5117 Orthops scutellatus Uhler [Hemiptera: Miridae]

5118 Proba sallei (Stal) [Hemiptera: Miridae]

5119 Leptopterna ferrugata (Fallen) [Hemiptera: Miridae]

5120 Stenodema virens (Linnaeus) [Hemiptera: Miridae]

5121 Phymata americana coloradensis Melin [Hemiptera: Phymatidae]

5122 Sinea spinicollis (Champion) [Hemiptera: Reduviidae]

5123 Hesperotingis occidentalis Drake [Hemiptera: Tingidae]

5124 Neides muticus (Say) [Hemiptera: Berytidae]

5125 Lygaeus kalmii kalmii Stal [Hemiptera: Lygaeidae]

5126 Melanocoryphus bicrucis (Say) [Hemiptera: Lygaeidae]

5127 Ortholomus scolopax Say [Hemiptera: Lygaeidae]

5128 Kleidocerys franciscanus (Stal) [Hemiptera: Lygaeidae]

5129 Geocoris pallens pallens Stal [Hemiptera: Lygaeidae]

5130 Coriomeris humilis (Uhler) [Hemiptera: Coreidae]

5131 Arhyssus barberi Harris [Hemiptera: Rhopalidae]

5132 Homaemus aeneifrons consors Uhler [Hemiptera: Scutelleridae]

5133 Aelia americana Dallas [Hemiptera: Pentatomidae]

5134 Carpocoris remotus Horvath [Hemiptera: Pentatomidae]

5135 Pitedia linguata (Say) [Hemiptera: Pentatomidae]

5136 Pitedia uhleri (Stal) [Hemiptera: Pentatomidae]

5137 Peribalus limbolarius (Stal) [Hemiptera: Pentatomidae]

5138 Perillus spp. [Hemiptera: Pentatomidae]

5139 Thyanta pallidovirens pallidovirens Stal [Hemiptera: Pentatomidae]

5140 Phymata pennsylvanica Handlirsch [Hemiptera: Phymatidae]

5141 Macrosteles spp. [Homoptera: Cicadellidae]

5142 Scolops abnormalis Ball [Homoptera: Dictyopharidae]

5143 Psylla galeaformis Patch [Homoptera: Psyllidae]

5144 Aphis eriogoni Cowen [Homoptera: Aphididae]

5145 Amonostherium lichtensioides (Cockerell) (Artemisia scale) [Homoptera: Pseudococcidae]

5146 Chorizococcus abortivus McKenzie [Homoptera: Pseudococcidae]

5147 Chorizococcus aphyllonis (Cockerell) [Homoptera: Pseudococcidae]

5148 Heliococcus stachyos (Ehrhorn) [Homoptera: Pseudococcidae]

5149 Phenacoccus colemani Ehrhorn [Homoptera: Pseudococcidae]

5150 Phenacoccus eschscholtziae McKenzie [Homoptera: Pseudococcidae]

5151 Rhizoecus gracilis McKenzie [Homoptera: Pseudococcidae]

5152 Aleuropteryx spp. [Neuroptera: Coniopterygidae]

5153 Hemerobius neadelphus Gurney [Neuroptera: Hemerobiidae]

5154 Kimminsia coloradensis (Banks) [Neuroptera: Hemerobiidae]

5155 Chrysopa oculata Say [Neuroptera: Chrysopidae]

5156 Eremochrysa fraterna Banks [Neuroptera: Chrysopidae]

5157 Bembidion nebraskense LeConte [Coleoptera: Carabidae]

5158 Lebia guttula LeConte [Coleoptera: Carabidae]

5159 Carpelimus diffusus (Casey) [Coleoptera: Staphylinidae]

5160 Pelecomalium puberulum Fauvel [Coleoptera: Staphylinidae]

5161 Philonthus politus Linnaeus [Coleoptera: Staphylinidae]

5162 Philonthus spp. [Coleoptera: Staphylinidae]

5163 Saprinus lubricus LeConte [Coleoptera: Histeridae]

5164 Platycerus piceus marginalis Casey [Coleoptera: Lucanidae]

5165 Dicerca frosti Nelson [Coleoptera: Buprestidae]

5166 Anthaxia helferi Cobos [Coleoptera: Buprestidae]

5167 Chrysobothris horningi Barr [Coleoptera: Buprestidae]

5168 Chrysobothris idahoensis Barr [Coleoptera: Buprestidae]

5169 Chrysobothris oregona Chamberlin [Coleoptera: Buprestidae]

5170 Athous rufiventris Eschscholtz [Coleoptera: Elateridae]

5171 Dalopius fuscatus Brown [Coleoptera: Elateridae]

5172 Podabrus falli R. & G. Hopping [Coleoptera: Cantharidae]

5173 Podabrus pruinosus diversipes Fall [Coleoptera: Cantharidae]

5174 Orphilus niger Rossi [Coleoptera: Dermestidae]

5175 Phyllobaenus scaber (LeConte) [Coleoptera: Cleridae]

5176 Tanaops ignitus [Coleoptera: Melyridae]

5177 Attalus morulus smithi Hopping [Coleoptera: Melyridae]

5178 Attalus oregonensis Horn [Coleoptera: Melyridae]

5179 Eurelymis atra (LeConte) [Coleoptera: Melyridae]

5180 Hoppingiana nitida Hatch [Coleoptera: Melyridae]

5181 Cardiophorus tenebrosus LeConte [Coleoptera: Elateridae]

5182 Mecomycter omalinus Horn [Coleoptera: Melyridae]

5183 Amecocerus quadricollis Hatch [Coleoptera: Melyridae]

5184 Amecocerus suckeri Hatch [Coleoptera: Melyridae]

5185 Lytta vulnerata cooperi LeConte [Coleoptera: Meloidae]

5186 Epicauta puncticollis (Mannerheim) [Coleoptera: Meloidae]

5187 Linsleya sphaericollis (Say) [Coleoptera: Meloidae]

5188 Nemognatha lutea dichroa LeConte [Coleoptera: Meloidae]

5189 Nemognatha nigripennis LeConte [Coleoptera: Meloidae]

5190 Mordella atrata Melsheimer [Coleoptera: Mordellidae]

5191 Mordellistena sericans Fall [Coleoptera: Mordellidae]

5192 Coniontellus subglaber Casey [Coleoptera: Tenebrionidae]

5193 Pentaria trifasciata Melsheimer [Coleoptera: Melandryidae]

5194 Anaspis rufa Say [Coleoptera: Melandryidae]

5195 Notoxus serratus LeConte [Coleoptera: Pedilidae]

5196 Brachypterus troglodytes Murray [Coleoptera: Nitidulidae]

5197 Cucujus clavipes puniceus Mannerheim [Coleoptera: Cucujidae]

5198 Brachyacantha ursina uteella Casey [Coleoptera: Coccinellidae]

5199 Scymnus caurinus Horn [Coleoptera: Coccinellidae]

5200 Scymnus lacustris LeConte [Coleoptera: Coccinellidae]

5201 Coccinella prolongata Casey [Coleoptera: Coccinellidae]

5202 Brumus septentrionis Weise [Coleoptera: Coccinellidae]

5203 Phalacrus penicillatus Say [Coleoptera: Phalacridae]

5204 Grammoptera spp. [Coleoptera: Cerambycidae]

5205 Anoplodera serpentina (Casey) [Coleoptera: Cerambycidae]

5206 Cortodera spp. [Coleoptera: Cerambycidae]

5207 Stenocorus utenaus Casey [Coleoptera: Cerambycidae]

5208 Brachyacantha dentipes (Fabricius) [Coleoptera: Coccinellidae]

5209 Pachybrachis caelatus LeConte [Coleoptera: Chrysomelidae]

5210 Pachybrachis mercurialis Fall [Coleoptera: Chrysomelidae]

5211 Pachybrachis vacillatus Fall [Coleoptera: Chrysomelidae]

5212 Cryptocephalus confluentus confluentus Say [Coleoptera: Chrysomelidae]

5213 Leptinotarsa decemlineata (Say) (Colorado potato beetle) [Coleoptera: Chrysomelidae]

5214 Galerucella luteola Muller [Coleoptera: Chrysomelidae]

5215 Luperodes nigrovirescens Fall [Coleoptera: Chrysomelidae]

5216 Altica prasina LeConte [Coleoptera: Chrysomelidae]

5217 Glyptina atriventris Horn [Coleoptera: Chrysomelidae]

5218 Dibolia borealis Chevrolat [Coleoptera: Chrysomelidae]

5219 Acanthoscelides pauperculus LeConte [Coleoptera: Bruchidae]

5220 Myrmex lineata lineata (Pascoe) [Coleoptera: Curculionidae]

5221 Tachypterellus consors Dietz [Coleoptera: Curculionidae]

5222 Tychius tectus LeConte [Coleoptera: Curculionidae]

5223 Ochlodes sylvanoides sylvanoides (Boisduval) [Lepidoptera: Hesperiidae]

5224 Hesperia harpalus harpalus (Edwards) [Lepidoptera: Hesperiidae]

5225 Pholisora catallus (Fabricius) [Lepidoptera: Hesperiidae]

5226 Mitoura spinetorum (Hewitson) [Lepidoptera: Lycaenidae]

5227 Strymon titus titus (Fabricius) [Lepidoptera: Lycaenidae]

5228 Strymon californica (Edwards) [Lepidoptera: Lycaenidae]

5229 Lycaena heteronea heteronea Boisduvall [Lepidoptera: Lycaenidae]

5230 Philotes battoides (Behr) [Lepidoptera: Lycaenidae]

5231 Macrosiagon dimidiatum (Fabricius) [Coleoptera: Mordellidae]

5232 Monoxia debilis LeConte [Coleoptera: Chrysomelidae]

5233 Euphydryas anicia (Doubleday) [Lepidoptera: Nymphalidae]

5234 Speyeria marmonia eurynome (Edwards) [Lepidoptera: Nymphalidae]

5235 Speyeria zerene cynna dos Passos & Grey [Lepidoptera: Nymphalidae]

5236 Speyeria callippe nevadensis (Edwards) [Lepidoptera: Nymphalidae]

5237 Danaus plexippus (Linnaeus) [Lepidoptera: Danaidae]

5238 Cercyonis oetus oetus (Boisduval) [Lepidoptera: Satyridae]

5239 Pseudohazis eglanterina nuttalli Strecker [Lepidoptera: Saturniidae]

5240 Copablepharon canariana McDunnough [Lepidoptera: Noctuidae]

5241 Schinia albafascia Smith [Lepidoptera: Noctuidae]

5242 Gyros muiri (Henry Edwards) [Lepidoptera: Pyralidae]

5243 Ethmia monticola (Walsingham) [Lepidoptera: Ethmiidae]

5244 Chrysopora spp. [Lepidoptera: Gelechiidae]

5245 Tipula pellucida Doane [Diptera: Tipulidae]

5246 Limonia candensis (Westwood) [Diptera: Tipulidae]

5247 Pericoma californica Kincaid [Diptera: Psychodidae]

5248 Thereva pseudoculata Cole [Diptera: Therevidae]

5249 Simulium vittatum Zetterstedt [Diptera: Simuliidae]

5250 Bibio albipennis albipennis Say [Diptera: Bibionidae]

5251 Bibio vestitus Walker [Diptera: Bibionidae]

5252 Anatella spp. [Diptera: Mycetophilidae]

5253 Thereva spp. [Diptera: Therevidae]

5254 Apachekolos confusio Martin [Diptera: Leptogastridae]

5255 Cophura brevicornis (Williston) [Diptera: Asilidae]

5256 Cyrtopogon willistoni Curran [Diptera: Asilidae]

5257 Dicolonus simplex Loew [Diptera: Asilidae]

5258 Stenopogon inquinatus Loew [Diptera: Asilidae]

5259 Stenopogon martini Bromley [Diptera: Asilidae]

5260 Laphria fernaldi (Back) [Diptera: Asilidae]

5261 Asilus auriannulatus (Hine) [Diptera: Asilidae]

5262 Machimus occidentalis (Hine) [Diptera: Asilidae]

5263 Mallophorina martinorum Cole [Diptera: Asilidae]

5264 Acrocera melanderi Cole [Diptera: Acroceridae]

5265 Bombylius facialis Cresson [Diptera: Bombyliidae]

5266 Anastoechus spp. [Diptera: Bombyliidae]

5267 Lordotus gibbus striatus Painter [Diptera: Bombyliidae]

5268 Thevenemyia muricata (Osten Sacken) [Diptera: Bombyliidae]

5269 Villa agrippina (Osten Sacken) [Diptera: Bombyliidae]

5270 Villa alternata alternata (Say) [Diptera: Bombyliidae]

5271 Villa lateralis lateralis (Say) [Diptera: Bombyliidae]

5272 Villa morio (Linnaeus) [Diptera: Bombyliidae]

5273 Villa nugator (Coquillett) [Diptera: Bombyliidae]

5274 Lepidanthrax spp. [Diptera: Bombyliidae]

5275 Chrysotus spp. [Diptera: Dolichopodidae]

5276 Dasysyrphus amalopis (Osten Sacken) [Diptera: Syrphidae]

5277 Sphaerophoria robusta Curran [Diptera: Syrphidae]

5278 Melanostoma spp. [Diptera: Syrphidae]

5279 Chrysotoxum integre Williston [Diptera: Syrphidae]

5280 Helophilus latifrons Loew [Diptera: Syrphidae]

5281 Asemosyrphus polygrammus (Loew) [Diptera: Syrphidae]

5282 Eristalis arbustorum (Linnaeus) [Diptera: Syrphidae]

5283 Physoconops fronto (Williston) [Diptera: Conopidae]

5284 Physocephala burgessi (Williston) [Diptera: Conopidae]

5285 Zodion americanus Weidemann [Diptera: Conopidae]

5286 Thecophora modesta (Williston) [Diptera: Conopidae]

5287 Psila dimidiata Loew [Diptera: Psilidae]

5288 Volucella bomylans rufomaculata Jones [Diptera: Syrphidae]

5289 Paracantha gentilis Hering [Diptera: Tephritidae]

5290 Sepsis biflexuosa Strobl [Diptera: Sepsidae]

5291 Pherbellia vitalis (Cresson) [Diptera: Sciomyzidae]

5292 Palloptera jucunda Loew [Diptera: Pallopteridae]

5293 Leptocera limosa (Fallen) [Diptera: Sphaeroceridae]

5294 Hydrellia griseola (Fallen) [Diptera: Ephydridae]

5295 Parydra nitida Cresson [Diptera: Ephydridae]

5296 Ochthera mantis (DeGeer) [Diptera: Ephydridae]

5297 Oscinella nitidissima (Meigen) [Diptera: Chloropidae]

5298 Goniopsita spp. [Diptera: Chloropidae]

5299 Meromyza pratorum Meigen [Diptera: Chloropidae]

5300 Meromyza saltatrix (Linnaeus) [Diptera: Chloropidae]

5301 Psuedoleria robusta Garrett [Diptera: Heleomyzidae]

5302 Hylemya variata (Fallen) [Diptera: Anthomyiidae]

5303 Hylemya brassicae (Bouche) [Diptera: Anthomyiidae]

5304 Mosillus bidentatus (Cresson) [Diptera: Ephydridae]

5305 Hylemya ceralis (Huckett) [Diptera: Anthomyiidae]

5306 Hylemya femorata Huckett [Diptera: Anthomyiidae]

5307 Hylemya lamellicauda Huckett [Diptera: Anthomyiidae]

5308 Hylemya montana Malloch [Diptera: Anthomyiidae]

5309 Hylemya neomexicana Malloch [Diptera: Anthomyiidae]

5310 Hylemya setiventris setiventris Stein [Diptera: Anthomyiidae]

5311 Pegomya hyoscyami betae (Curtis) [Diptera: Anthomyiidae]

5312 Hydrophoria divisa (Meigen) [Diptera: Anthomyiidae]

5313 Hydrophoria wierzejskii (Mik) [Diptera: Anthomyiidae]

5314 Lispe patellata Aldrich [Diptera: Muscidae]

5315 Helina bohemani (Ringdahl) [Diptera: Muscidae]

5316 Quadrularia laetifica (Robineau-Desvoidy) [Diptera: Muscidae]

5317 Pogonomyia minor Malloch [Diptera: Muscidae]

5318 Lasiops septenrionalis (Stein) [Diptera: Muscidae]

5319 Muscina assimilis (Fallen) [Diptera: Muscidae]

5320 Muscina stabulans (Fallen) [Diptera: Muscidae]

5321 Graphomya maculata (Scopoli) [Diptera: Muscidae]

5322 Protophormia terraenovae (Robineau-Desvoidy) [Diptera: Calliphoridae]

5323 Protocalliphora spp. [Diptera: Calliphoridae]

5324 Helina duplicata (Meigen) [Diptera: Muscidae]

5325 Calliphora livida Hall [Diptera: Calliphoridae]

5326 Senotainia vigilans Allen [Diptera: Sarcophagidae]

5327 Wohlfahrtia vigil (Walker) [Diptera: Sarcophagidae]

5328 Blaesoxipha aculeata (Aldrich) [Diptera: Sarcophagidae]

5329 Blaesoxipha atlanis (Aldrich) [Diptera: Sarcophagidae]

5330 Blaesoxipha kellyi (Aldrich) [Diptera: Sarcophagidae]

5331 Ravinia querula (Walker) [Diptera: Sarcophagidae]

5332 Sarcophaga cooleyi Parker [Diptera: Sarcophagidae]

5333 Gymnosoma filiola Loew [Diptera: Tachinidae]

5334 Xanthomelanodes californicus Townsend [Diptera: Tachinidae]

5335 Cylindromyia californica (Bigot) [Diptera: Tachinidae]

5336 Cylindromyia decora Aldrich [Diptera: Tachinidae]

5337 Cylindromyia fumipennis (Bigot) [Diptera: Tachinidae]

5338 Steveniopsis rubidiapex (Townsend) [Diptera: Tachinidae]

5339 Arctophyto gillettei (Townsend) [Diptera: Tachinidae]

5340 Mochlosoma illocale Reinhard [Diptera: Tachinidae]

5341 Nowickia latigena (Tothill) [Diptera: Tachinidae]

5342 Nowickia piceifrons (Townsend) [Diptera: Tachinidae]

5343 Nowickia nitida (Wulp) [Diptera: Tachinidae]

5344 Peleteria bryanti Curran [Diptera: Tachinidae]

5345 Peleteria malleola (Bigot) [Diptera: Tachinidae]

5346 Deopalpus contiguus (Reinhard) [Diptera: Tachinidae]

5347 Melanophrys flavipennis Williston [Diptera: Tachinidae]

5348 Chaetophlepsis eudryae (Smith) [Diptera: Tachinidae]

5349 Paradidyma singularis (Townsend) [Diptera: Tachinidae]

5350 Blondelia polita (Townsend) [Diptera: Tachinidae]

5351 Eribella polita (Coquillett) [Diptera: Tachinidae]

5352 Clausicella setigera (Coquillett) [Diptera: Tachinidae]

5353 Clastoneuriopsis deceptor (Curran) [Diptera: Tachinidae]

5354 Onychogonia magna Brooks [Diptera: Tachinidae]

5355 Spallanzania hebes (Fallen) [Diptera: Tachinidae]

5356 Siphosturmia melitaeae (Coquillett) [Diptera: Tachinidae]

5357 Frontiniella parancilla Townsend [Diptera: Tachinidae]

5358 Aphilodyctium fidum (Cresson) [Hymenoptera: Tenthredinidae]

5359 Tenthredo xantha Norton [Hymenoptera: Tenthredinidae]

5360 Meteorus hyphantriae Riley [Hymenoptera: Braconidae]

5361 Apanteles monticola Ashmead [Hymenoptera: Braconidae]

5362 Microgaster comptanae Viereck [Hymenoptera: Braconidae]

5363 Bracon tychii (Muesebeck) [Hymenoptera: Braconidae]

5364 Noserus spp. [Hymenoptera: Braconidae]

5365 Pimpla sanguinipes erythropus Viereck [Hymenoptera: Ichneumonidae]

5366 Zatypota percontatoria (Muller) [Hymenoptera: Ichneumonidae]

5367 Exenterus tsugae Cushman [Hymenoptera: Ichneumonidae]

5368 Gelis spp. [Hymenoptera: Ichneumonidae]

5369 Phygadeuon spp. [Hymenoptera: Ichneumonidae]

5370 Cryptus genatus (Pratt) [Hymenoptera: Ichneumonidae]

5371 Cryptus spp. [Hymenoptera: Ichneumonidae]

5372 Mesostenus gracilis Cresson [Hymenoptera: Ichneumonidae]

5373 Phaeogenes arogae Gittins & Henry [Hymenoptera: Ichneumonidae]

5374 Centeterus spp. [Hymenoptera: Ichneumonidae]

5375 Dicaelotus spp. [Hymenoptera: Ichneumonidae]

5376 Anisobas coloradensis (Cresson) [Hymenoptera: Ichneumonidae]

5377 Cratichneumon spp. [Hymenoptera: Ichneumonidae]

5378 Pseudamblyteles ormenus (Cresson) [Hymenoptera: Ichneumonidae]

5379 Pseudamblyteles spp. [Hymenoptera: Ichneumonidae]

5380 Ichneumon spp. [Hymenoptera: Ichneumonidae]

5381 Catadelphops buccatus (Cresson) [Hymenoptera: Ichneumonidae]

5382 Glypta spp. [Hymenoptera: Ichneumonidae]

5383 Exetastes rufipes Cresson [Hymenoptera: Ichneumonidae]

5384 Exetastes spp. [Hymenoptera: Ichneumonidae]

5385 Homotropus nigritarsus fuscitarsus (Provancher) [Hymenoptera: Ichneumonidae]

5386 Chorinaeus spp. [Hymenoptera: Ichneumonidae]

5387 Triclistus spp. [Hymenoptera: Ichneumonidae]

5388 Hypsicera spp. [Hymenoptera: Ichneumonidae]

5389 Cymodusopsis aristoteliae Viereck [Hymenoptera: Ichneumonidae]

5390 Campoletis spp. [Hymenoptera: Ichneumonidae]

5391 Dimorpha prima (Cushman) [Hymenoptera: Ichneumonidae]

5392 Barycnemis spp. [Hymenoptera: Ichneumonidae]

5393 Ophion spp. [Hymenoptera: Ichneumonidae]

5394 Genophion costalis (Cresson) [Hymenoptera: Ichneumonidae]

5395 Trichionotus spp. [Hymenoptera: Ichneumonidae]

5396 Sympiesis stigmatipennis Girault [Hymenoptera: Eulophidae]

5397 Monodontomerus montivagus Ashmead [Hymenoptera: Torymidae]

5398 Pseudotorymus lazulellus (Ashmead) [Hymenoptera: Torymidae]

5399 Asaphes spp. [Hymenoptera: Pteromalidae]

5400 Amblymerus bruchophagi (Gahan) [Hymenoptera: Pteromalidae]

5401 Amblymerus verdifer (Norton) [Hymenoptera: Pteromalidae]

5402 Caenacis spp. [Hymenoptera: Pteromalidae]

5403 Habrocytus coloradensis (Ashmead) [Hymenoptera: Pteromalidae]

5404 Habrocytus medicaginis Gahan [Hymenoptera: Pteromalidae]

5405 Habrocytus piercei Crawford [Hymenoptera: Pteromalidae]

5406 Eurytoma juniperina Marcovitch [Hymenoptera: Eurytomidae]

5407 Brachymeria compsilurae (Crawford) [Hymenoptera: Chalcididae]

5408 Leucospis affinis affinis Say [Hymenoptera: Leucospididae]

5409 Gasteruption spp. [Hymenoptera: Gasteruptiidae]

5410 Belyta spp. [Hymenoptera: Diapriidae]

5411 Hedychrum nigropilosum Mocsary [Hymenoptera: Chrysididae]

5412 Chrysura densa (Cresson) [Hymenoptera: Chrysididae]

5413 Chrysis coerulans Fabricius [Hymenoptera: Chrysididae]

5414 Chrysis coloradensis R. Bohart [Hymenoptera: Chrysididae]

5415 Chrysis snowi Viereck [Hymenoptera: Chrysididae]

5416 Cleptes purpuratus Cresson [Hymenoptera: Chrysididae]

5417 Perisierola cellularis (Say) [Hymenoptera: Bethylidae]

5418 Sierolomorpha nigrescens Evans [Hymenoptera: Sierolomorphidae]

5419 Odontophotopsis pudica (Melander) [Hymenoptera: Mutillidae]

5420 Leptothorax nevadensis eldoradensis Wheeler [Hymenoptera: Formicidae]

5421 Leptothorax rugatulus rugatulus Emery [Hymenoptera: Formicidae]

5422 Camponotus laevigatus F. Smith [Hymenoptera: Formicidae]

5423 Formica integroides coloradensis Wheeler [Hymenoptera: Formicidae]

5424 Formica neorufibarbis neorufibarbis Emery [Hymenoptera: Formicidae]

5425 Formica whymperi alpina Wheeler [Hymenoptera: Formicidae]

5426 Pseudomasaris zonalis (Cresson) [Hymenoptera: Vespidae]

5427 Lasius niger (Linnaeus) [Hymenoptera: Formicidae]

5428 Eumenes verticalis coloradensis Cresson [Hymenoptera: Eumenidae]

5429 Euodynerus discogaster (Bequaert) [Hymenoptera: Eumenidae]

5430 Euodynerus leucomelas (Saussure) [Hymenoptera: Eumenidae]

5431 Euodynerus tempiferus eldoradensis (Rohwer) [Hymenoptera: Eumenidae]

5432 Ancistrocerus antilope antilope (Panzer) [Hymenoptera: Eumenidae]

5433 Ancistrocerus catskill albophaleratus (Saussure) [Hymenoptera: Eumenidae]

5434 Ancistrocerus catskill catskill (Saussure) [Hymenoptera: Eumenidae]

5435 Ancistrocerus lineativentris lineativentris Cameron [Hymenoptera: Eumenidae]

5436 Parancistrocerus spp. [Hymenoptera: Eumenidae]

5437 Maricopdynerus rudiceps R. Bohart [Hymenoptera: Eumenidae]

5438 Chirodamus pyrrhomelas (Walker) [Hymenoptera: Pompilidae]

5439 Tachypompilus unicolor unicolor (Banks) [Hymenoptera: Pompilidae]

5440 Astata leuthstromi Ashmead [Hymenoptera: Sphecidae]

5441 Dryudella aspersa (Fox) [Hymenoptera: Sphecidae]

5442 Dryudella caerulea (Cresson) [Hymenoptera: Sphecidae]

5443 Tachytes fulviventris fulviventris Cresson [Hymenoptera: Sphecidae]

5444 Mimesa gregaria (Fox) [Hymenoptera: Sphecidae]

5445 Prionyx atratus (Lepeletier) [Hymenoptera: Sphecidae]

5446 Podalonia communis (Cresson) [Hymenoptera: Sphecidae]

5447 Podalonia luctuosa (Smith) [Hymenoptera: Sphecidae]

5448 Podalonia occidentalis Murray [Hymenoptera: Sphecidae]

5449 Ammophila extremitata Cresson [Hymenoptera: Sphecidae]

5450 Ammophila juncea Cresson [Hymenoptera: Sphecidae]

5451 Ammophila stangei Dahlbom [Hymenoptera: Sphecidae]

5452 Gorytes albosignatus Fox [Hymenoptera: Sphecidae]

5453 Steniolia obliqua (Cresson) [Hymenoptera: Sphecidae]

5454 Stictiella megacera Parker [Hymenoptera: Sphecidae]

5455 Bembix spinolae Lepeletier [Hymenoptera: Sphecidae]

5456 Philanthus anna Dunning [Hymenoptera: Sphecidae]

5457 Philanthus politus pacificus Cresson [Hymenoptera: Sphecidae]

5458 Aphilanthops subfrigidus Dunning [Hymenoptera: Sphecidae]

5459 Cerceris californica californica Cresson [Hymenoptera: Sphecidae]

5460 Eucerceris flavocincta Cresson [Hymenoptera: Sphecidae]

5461 Crabro latipes Smith [Hymenoptera: Sphecidae]

5462 Crossocerus spp. [Hymenoptera: Sphecidae]

5463 Ectemnius dilectus dilectus (Cresson) [Hymenoptera: Sphecidae]

5464 Oxybelus argenteopilosum Cameron [Hymenoptera: Sphecidae]

5465 Oxybelus similis Cresson [Hymenoptera: Sphecidae]

5466 Colletes consors pascoensis Cockerell [Hymenoptera: Colletidae]

5467 Colletes fulgidus fulgidus Swenk [Hymenoptera: Colletidae]

5468 Colletes kincaidii Cockerell [Hymenoptera: Colletidae]

5469 Colletes lutzi interior Timberlake [Hymenoptera: Colletidae]

5470 Hylaeus rudbeckiae (Cockerell & Casad) [Hymenoptera: Colletidae]

5471 Hylaeus wootoni (Cockerell) [Hymenoptera: Colletidae]

5472 Hylaeus lunicraterius Snelling [Hymenoptera: Colletidae]

5473 Hylaeus rugulosus episcopalis (Cockerell) [Hymenoptera: Colletidae]

5474 Andrena colletina Cockerell [Hymenoptera: Andrenidae]

5475 Andrena surda Cockerell [Hymenoptera: Andrenidae]

5476 Philanthus politus [Hymenoptera: Sphecidae]

5477 Andrena transnigra transnigra Viereck [Hymenoptera: Andrenidae]

5478 Andrena chapmanae Viereck [Hymenoptera: Andrenidae]

5479 Andrena cressoni Robertson [Hymenoptera: Andrenidae]

5480 Andrena knuthiana Cockerell [Hymenoptera: Andrenidae]

5481 Andrena w-scripta Viereck [Hymenoptera: Andrenidae]

5482 Perdita aemula Timberlake [Hymenoptera: Andrenidae]

5483 Lasioglossum trizonatum (Cresson) [Hymenoptera: Halictidae]

5484 Lasioglossum cooleyi (Crawford) [Hymenoptera: Halictidae]

5485 Lasioglossum ruficorne (Crawford) [Hymenoptera: Halictidae]

5486 Dialictus actinosus (Sandhouse) [Hymenoptera: Halictidae]

5487 Dialictus albohirtus (Crawford) [Hymenoptera: Halictidae]

5488 Dialictus pruinosus (Robertson) [Hymenoptera: Halictidae]

5489 Dialictus ruidosenis (Cockerell) [Hymenoptera: Halictidae]

5490 Agapostemon texanus texanus Cresson [Hymenoptera: Halictidae]

5491 Anthidium emarginatum (Say) [Hymenoptera: Megachilidae]

5492 Anthidium tenuiflorae tenuiflorae Cockerell [Hymenoptera: Megachilidae]

5493 Perdita wyomingensis segona Timberlake [Hymenoptera: Andrenidae]

5494 Callanthidium formosum (Cresson) [Hymenoptera: Megachilidae]

5495 Dianthidium subparvum subparvum Swenk [Hymenoptera: Megachilidae]

5496 Dianthidium ulkei perterritum Cockerell [Hymenoptera: Megachilidae]

5497 Dianthidium ulkei ulkei (Cresson) [Hymenoptera: Megachilidae]

5498 Anthidiellum notatum robertsoni (Cockerell) [Hymenoptera: Megachilidae]

5499 Stelis montana Cresson [Hymenoptera: Megachilidae]

5500 Stelis subemarginata (Cresson) [Hymenoptera: Megachilidae]

5501 Chelostoma phaceliae Michener [Hymenoptera: Megachilidae]

5502 Ashmeadiella bucconis denticultata (Cresson) [Hymenoptera: Megachilidae]

5503 Ashmeadiella californica californica (Ashmead) [Hymenoptera: Megachilidae]

5504 Hoplitis albifrons argentifrons (Cresson) [Hymenoptera: Megachilidae]

5505 Hoplitis louisae (Cockerell) [Hymenoptera: Megachilidae]

5506 Osmia marginipennis Cresson [Hymenoptera: Megachilidae]

5507 Osmia montana montana Cresson [Hymenoptera: Megachilidae]

5508 Osmia indeprensa (Sandhouse) [Hymenoptera: Megachilidae]

5509 Osmia brevis brevis Cresson [Hymenoptera: Megachilidae]

5510 Megachile manifesta Cresson [Hymenoptera: Megachilidae]

5511 Megachile nevadensis Cresson [Hymenoptera: Megachilidae]

5512 Megachile parallela parallela Smith [Hymenoptera: Megachilidae]

5513 Megachile perihirta Cockerell [Hymenoptera: Megachilidae]

5514 Megachile mellitarsis Cresson [Hymenoptera: Megachilidae]

5515 Megachile pugnata pugnata Say [Hymenoptera: Megachilidae]

5516 Nomada spp. [Hymenoptera: Anthophoridae]

5517 Epeolus compactus Cresson [Hymenoptera: Anthophoridae]

5518 Diadasia australis australis (Cresson) [Hymenoptera: Anthophoridae]

5519 Anthophora ursina simillima Cresson [Hymenoptera: Anthophoridae]

5520 Anthophora flexipes Cresson [Hymenoptera: Anthophoridae]

5521 Ceratina nanula nanula Cockerell [Hymenoptera: Anthophoridae]

5522 Bombus nevadensis nevadensis Cresson [Hymenoptera: Apidae]

5523 Bombus appositus Cresson [Hymenoptera: Apidae]

5524 Bombus occidentalis occidentalis Greene [Hymenoptera: Apidae]

5525 Bombus centralis Cresson [Hymenoptera: Apidae]

5526 Bombus huntii Greene [Hymenoptera: Apidae]

5527 Anthidium placitum placitum Cresson [Hymenoptera: Megachilidae]

5528 Ancistrocerus catskill halophilus Viereck [Hymenoptera: Eumenidae]

5529 Ancistrocerus spilogaster Cameron [Hymenoptera: Eumenidae]

5530 Ancistrocerus tigris cytainus (Cameron) [Hymenoptera: Eumenidae]

5531 Euodynerus foraminatus scutellaris (Saussure) [Hymenoptera: Eumenidae]

5532 Leptochilus rufoinodus (Cresson) [Hymenoptera: Eumenidae]

5533 Parancistrocerus acarigaster Bohart [Hymenoptera: Eumenidae]

5534 Parancistrocerus acarophorus Bohart [Hymenoptera: Eumenidae]

5535 Parancistrocerus toltecus (Saussure) [Hymenoptera: Eumenidae]

5536 Stenodynerus conoides Bohart [Hymenoptera: Eumenidae]

5537 Symmorhpus meridionalis Viereck [Hymenoptera: Eumenidae]

5538 Symmorphus cristatus nevadensis (Cameron) [Hymenoptera: Eumenidae]

5539 Symmorphus projectus Bohart [Hymenoptera: Eumenidae]

5540 Auplopus nigrellus (Banks) [Hymenoptera: Pompilidae]

5541 Dipogon calipterus nubifer (Cresson) [Hymenoptera: Pompilidae]

5542 Stenodynerus blandus (Saussure) [Hymenoptera: Eumenidae]

5543 Ancistrocerus antilope (Panzer) [Hymenoptera: Eumenidae]

5544 Ancistrocerus lineativentris Cameron [Hymenoptera: Eumenidae]

5545 Crossocerus fergusoni Pate [Hymenoptera: Sphecidae]

5546 Psenulus alienus (Krombein) [Hymenoptera: Sphecidae]

5547 Crossocerus isolens (Fox) [Hymenoptera: Sphecidae]

5548 Euplilis arapaho Pate [Hymenoptera: Sphecidae]

5549 Pemphredon errans Rohwer [Hymenoptera: Sphecidae]

5550 Pemphredon giffardi (Rohwer) [Hymenoptera: Sphecidae]

5551 Pisonopsis birkmanni Rohwer [Hymenoptera: Sphecidae]

5552 Solierella blaisdelli (Bridwell) [Hymenoptera: Sphecidae]

5553 Solierella similis (Bridwell) [Hymenoptera: Sphecidae]

5554 Stigmus inordinatus Fox [Hymenoptera: Sphecidae]

5555 Tracheliodes foveolineatus (Viereck) [Hymenoptera: Sphecidae]

5556 Trypoxylon tridentatum Packard [Hymenoptera: Sphecidae]

5557 Trypoxylon bidentatum Fox [Hymenoptera: Sphecidae]

5558 Trypoxylon sculleni Sandhouse [Hymenoptera: Sphecidae]

5559 Hylaeus verticalis (Cresson) [Hymenoptera: Colletidae]

5560 Anthidium maculosum Cresson [Hymenoptera: Megachilidae]

5561 Ashmeadiella aridula Cockerell [Hymenoptera: Megachilidae]

5562 Ashmeadiella inyoensis Michener [Hymenoptera: Megachilidae]

5563 Ashmeadiella timberlakei Michener [Hymenoptera: Megachilidae]

5564 Hoplitis colei (Crawford) [Hymenoptera: Megachilidae]

5565 Hoplitis fulgida platyura (Cockerell) [Hymenoptera: Megachilidae]

5566 Hoplitis hypocrita (Cockerell) [Hymenoptera: Megachilidae]

5567 Hoplitis producta gracilis (Michener) [Hymenoptera: Megachilidae]

5568 Hoplitis sambuci Titus [Hymenoptera: Megachilidae]

5569 Megachile brevis Say [Hymenoptera: Megachilidae]

5570 Megachile concinna Smith [Hymenoptera: Megachilidae]

5571 Megachile gemula Cresson [Hymenoptera: Megachilidae]

5572 Megachile montivaga Cresson [Hymenoptera: Megachilidae]

5573 Megachile rotundata (Fabricius) [Hymenoptera: Megachilidae]

5574 Osmia kincaidii Cockerell [Hymenoptera: Megachilidae]

5575 Proteriades bullifacies (Michener) [Hymenoptera: Megachilidae]

5576 Proteriades mojavensis (Michener) [Hymenoptera: Megachilidae]

5577 Aspidiotus camelliae Signoret (Greedy scale) [Homoptera: Diaspididae]

5578 Chrysomphalus aurantii (Maskell) (Red scale) [Homoptera: Diaspididae]

5579 Tetraleurodes acaciae (Quaintance) (Acacia whitefly) [Homoptera: Aleyrodidae]

5580 Scobicia suturalis (Horn) [Coleoptera: Bostrichidae] Immature/Adult Guild: Wood borer/?

5581 Polycaon confertus LeConte (Branch and twig borer) [Coleoptera: Bostrichidae] Immature/Adult Guild: Wood borer/Wood borer

5582 Pantomorus godmani (Crotch) (Fuller's rose weevil) [Coleoptera: Curculionidae] Immature/Adult Guild: Root feeder/? Oviposition Medium: Bark crevices

5583 Sabulodes caberata Guenee (Omnivorous looper) [Lepidoptera: Geometridae] Overwintering Stage: Adults,eggs,larvae Oviposition Medium: Leaf surfaces Generations Per Year: Several

5584 Tortrix citrana Fernald (Orange tortrix) [Lepidoptera: Tortricidae] Immature/Adult Guild: Fruit,leaf feeder/? Oviposition Medium: Leaf surfaces

5585 Taeniothrips inconsequens (Uzel) (Pear thrips) [Thysanoptera: Thripidae] Immature/Adult Guild: Bud,flower,leaf feeder/Bud,flower,leaf feeder Overwintering Stage: Adults Oviposition Medium: Stems,petioles

5586 Rhizaecus terrestris (Newstead) (Ground mealybug) [Homoptera: Eriococcidae]

5587 Aeolothrips kuwanai Moulton (Kuwana's thrips) [Thysanoptera: Aeolothripidae]

5588 Eriococcus adenostomae Ehrhorn [Homoptera: Eriococcidae]

5589 Pseudococcus crawi (Coquillett) (White sage mealybug) [Homoptera: Pseudococcidae] Immature/Adult Guild: Sap feeder: leaves,stems/Sap feeder: leaves,stems

5590 Lecaniodiaspis rufescens (Cockerell) (Chamise scale) [Homoptera: Asterolecaniidae]

5591 Hoplia callipyge LeConte (Grapevine hoplia) [Coleoptera: Scarabaeidae] Immature/Adult Guild: ?/Bud,flower feeder

5592 Haltica foliacea LeConte (Apple flea beetle) [Coleoptera: Chrysomelidae]

5593 Amitermes arizonensis Banks (Arizona termite) [Isoptera: Termitidae] Immature/Adult Guild: Termite/Termite

5594 Parthenothrips dracaenae (Heeger) (Draceaena thrips) [Thysanoptera: Thripidae]

5595 Scyphophorus yuccae Horn (Yucca weevil) [Coleoptera: Curculionidae] Immature/Adult Guild: Stem borer/Sap feeder

5596 Zerene eurydice Boisduvall (California dog-face,flying pansy) [Lepidoptera: Pieridae]

5597 Aeolothrips longiceps Crawford (Artemisia thrips) [Thysanoptera: Aeolothripidae]

5598 Aphalara calthae Linnaeus (Knotweed psyllid) [Homoptera: Psyllidae]

5599 Chaitophorus artemisiae Gillette [Homoptera: Aphididae]

5600 Macrosiphum artemisiae (Fonsc.) (Artemisia aphid) [Homoptera: Aphididae]

5601 Phenacoccus artemisiae Ehrhorn [Homoptera: Pseudococcidae]

5602 Chrysomphalus rossi (Maskell) (Black auraucaria scale) [Homoptera: Diaspididae]

5603 Cryptocephalus castaneus LeConte (Castaneous beetle) [Coleoptera: Chrysomelidae] Immature/Adult Guild: ?/Leaf feeder

5604 Colaspidea smaragdula (LeConte) [Coleoptera: Chrysomelidae]

5605 Eupagoderes geminatus Horn (White bud weevil) [Coleoptera: Curculionidae]

5606 Eriococcus tinsleyi Cockerell [Homoptera: Eriococcidae] Immature/Adult Guild: Root feeder/Root feeder

5607 Lepidosaphes concolor Cockerell [Homoptera: Diaspididae]

5608 Monoxia puncticollis (Say) [Coleoptera: Chrysomelidae]

5609 Oidematophorus monodactylus (Linnaeus) (Morning glory plume moth) [Lepidoptera: Pterophoridae]

5610 Platypedia minor Uhler (Minor cicada) [Homoptera: Cicadidae]

5611 Anuraphis helichrysi Kaltenbach (Leaf curl plum aphid) [Homoptera: Aphididae]

5612 Macrosiphum rudbeckiae Fitch (Cone flower aphid) [Homoptera: Aphididae]

5613 Lygus praetensis (Linnaeus) (Tarnished plant bug) [Hemiptera: Miridae]

5614 Bemisia berbericola (Cockerell) (Barberry whitefly) [Homoptera: Aleyrodidae]

5615 Tetraleurodes usorum (Cockerell) (Bearberry whitefly) [Homoptera: Aleyrodidae]

5616 Pterophorus tenuidactylus (Fitch) (Berry plume moth) [Lepidoptera: Pterophoridae] Immature/Adult Guild: Bud,leaf feeder/?

5617 Agromyza pruinosa Coquillett [Diptera: Agromyzidae] Immature/Adult Guild: Cambium miner/?

5618 Aphis gossypii Glover (Cotton or melon aphid) [Homoptera: Aphididae]

5619 Tortrix franciscana (Walsingham) (Apple skin worm) [Lepidoptera: Tortricidae]

5620 Cossonus hubbardi Schwartz [Coleoptera: Curculionidae] Immature/Adult Guild: Stem borer: dead stems/?

5621 Kalotermes hubbardi Caudell (Hubbard's termite) [Isoptera: Kalotermitidae]

5622 Spongovostox apicedentata Caudell [Dermaptera: Labiidae]

5623 Ankothrips robustus Crawford (Robust thrips) [Thysanoptera: Aeolothripidae]

5624 Myzus circumflexum (Buckton) (Lily aphid) [Homoptera: Aphididae] Immature/Adult Guild: Sap feeder: buds,leaves,shoots/Sap feeder: buds,leaves,shoots

5625 Tetraleurodes dorseyi (Kirkaldy) (Laurel whitefly) [Homoptera: Aleyrodidae]

5626 Tetraleurodes nigrans (Bemis) (Black aleyrodid) [Homoptera: Aleyrodidae]

5627 Hedrobia granosa LeConte (Oak limb beetle) [Coleoptera: Anobiidae] Immature/Adult Guild: Wood borer: dead wood/?

5628 Platycerus oregonensis Westwood (Oregon stag beetle) [Coleoptera: Lucanidae] Immature/Adult Guild: Wood borer: dead wood/?

5629 Xestoleptura crassipes (LeConte) [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer/?

5630 Coccus hesperidium Linnaeus (Soft brown scale) [Homoptera: Coccidae] Generations Per Year: Several

5631 Orothrips kelloggi Moulton (Kellogg's thrips) [Thysanoptera: Aeolothripidae]

5632 Clastoptera obtusa (Say) (Ceanothus spittlebug) [Homoptera: Cercopidae]

5633 Paratrioza maculipennis (Crawford) (Spotted-winged psyllid) [Homoptera: Psyllidae]

5634 Arytaina ceanothi Crawford (Ceanothus psyllid) [Homoptera: Psyllidae]

5635 Lepidosaphes ceanothi Ferris [Homoptera: Diaspididae]

5636 Chionaspis lintneri Comstock (Lintner's scale) [Homoptera: Diaspididae]

5637 Anthreneus scrophulariae (Linnaeus) (Buffalo carpet beetle) [Coleoptera: Dermestidae]

5638 Pachybrachys lustrans LeConte [Coleoptera: Chrysomelidae]

5639 Adaleres ovipennis Casey (Adaleres) [Coleoptera: Curculionidae]

5640 Samia gloveri Strecker (Glover's silk moth) [Lepidoptera: Saturniidae]

5641 Aegeria mellinipennis (Boisduvall) (Western sycamore borer) [Lepidoptera: Sesiidae] Immature/Adult Guild: Wood borer: live wood/?

5642 Nepticula punctulata Braun [Lepidoptera: Nepticulidae] Immature/Adult Guild: Leaf miner/?

5643 Pachypsylla celtidismamma Riley (Hackberry gall psyllid) [Homoptera: Psyllidae] Immature/Adult Guild: Gall former: leaves/?

5644 Pulvinaria vitis Linnaeus (Cottony maple or vine scale) [Homoptera: Coccidae]

5645 Pseudohazis eglanterina (Boisduvall) (Brown day moth) [Lepidoptera: Saturniidae] Overwintering Stage: Larvae,pupae Oviposition Medium: Twig surfaces

5646 Anthaxia deleta LeConte [Coleoptera: Buprestidae]

5647 Lyonetia speculella Clemens [Lepidoptera: Lyonetiidae] Immature/Adult Guild: Leaf feeder/?

5648 Aspidiotus ancylus (Putnam) (Putnam's scale) [Homoptera: Diaspididae]

5649 Aspidiotus forbesi Johnson (Cherry scale) [Homoptera: Diaspididae]

5650 Papilio daunus Boisduvall (Daunus) [Lepidoptera: Papilionidae] Immature/Adult Guild: Leaf feeder/?

5651 Aegeria opalescens Henry Edwards (Pacific peach tree borer) [Lepidoptera: Sesiidae] Immature/Adult Guild: Wood borer/? Oviposition Medium: Bark crevices,surfaces

5652 Scolytus rugulosus Ratzeburg (Shot hole borer, fruit tree bark beetle) [Coleoptera: Scolytidae]

5653 Sciara pauciesta Felt [Diptera: Sciaridae]

5654 Pteronidea thoracica (Harrington) [Hymenoptera: Tenthredinidae] Immature/Adult Guild: Epidermal feeder/?

5655 Taeniopteryx pacifica Banks (Salmonfly) [Plecoptera: Nemouridae] Immature/Adult Guild: ?/Flower,fruit feeder

5656 Lyctus linearis (Goeze) (European lyctus) [Coleoptera: Lyctidae] Immature/Adult Guild: Wood borer: dead wood/?

5657 Dasyneura pergandei Felt [Diptera: Cecidomyiidae] Immature/Adult Guild: Gall former: fruit/?

5658 Sphinx drupiferarum A. & S. (Wild cherry or plum sphinx) [Lepidoptera: Sphingidae]

5659 Sphinx sequoia Boisduvall (Sequoia sphinx) [Lepidoptera: Sphingidae] Oviposition Medium: Leaf undersides

5660 Smerinthus jamaicensis Drury (Twin-spot sphinx) [Lepidoptera: Sphingidae]

5661 Halisidota maculata alni Henry Edwards (Woolly bear) [Lepidoptera: Arctiidae]

5662 Phyllonorycter crataegella (Clemens) (Apple leaf blotch miner) [Lepidoptera: Gracilariidae]

5663 Hoplocampa cookei (Clarke) (Cherry fruit sawfly) [Hymenoptera: Tenthredinidae]

5664 Pseudococcus cockerelli King [Homoptera: Pseudococcidae]

5665 Coccoctorus scutellaris LeConte (Plum gouger) [Coleoptera: Curculionidae]

5666 Laspeyresia prunivora Walsingham (Lesser apple worm) [Lepidoptera: Olethreutidae]

5667 Tachardia fulgens Cockerell [Homoptera: Lacciferidae]

5668 Bemisia inconspicua (Quaintance) (Inconspicuous whitefly) [Homoptera: Aleyrodidae]

5669 Trialeurodes glacialis (Bemis) (Glacial whitefly) [Homoptera: Aleyrodidae]

5670 Trialeurodes tentaculatus (Bemis) (Tentacular whitefly) [Homoptera: Aleyrodidae]

5671 Ficana apicalis (Dallas) (Clematis bug) [Hemiptera: Coreidae]

5672 Tachardiella larrae (Comstock) (Creosote bush lac scale) [Homoptera: Lacciferidae]

5673 Gypona octolineata (Say) (Eight-lined leafhopper) [Homoptera: Cicadellidae]

5674 Empoa rosae Linnaeus (Rose leafhopper) [Homoptera: Cicadellidae]

5675 Archips rosaceana (Harris) (Oblique-banded leafroller) [Lepidoptera: Tortricidae] Immature/Adult Guild: Defoliator,leafroller/? Overwintering Stage: Eggs Oviposition Medium: Branch surfaces Generations Per Year: 1

5676 Myzus braggi Gillette (Artichoke aphid) [Homoptera: Aphididae]

5677 Cicadella circellata (Baker) (Blue sharpshooter) [Homoptera: Cicadellidae]

5678 Anuraphis sambucifoliae (Fitch) (Elder aphid) [Homoptera: Aphididae]

5679 Illinoia stanleyi (Wilson) (Elderberry aphid) [Homoptera: Aphididae]

5680 Epitrix cucumeris Harris (Potato flea beetle) [Coleoptera: Chrysomelidae] Immature/Adult Guild: Root feeder/Leaf feeder Generations Per Year: 1-2

5681 Luceria tranquilla (Grote) [Lepidoptera: Noctuidae]

5682 Aeolothrips annectans Hood (Annectant thrips) [Thysanoptera: Aeolothripidae] Immature/Adult Guild: Predator/Predator

5683 Agallia oculata Van Duzee [Homoptera: Cicadellidae]

5684 Desmocerus auripennis Chev. (Golden-winged elder borer) [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer: live wood/? Generations Per Year: 1/2

5685 Timema californica Scudder (California timema) [Orthoptera: Timemidae]

5686 Xylocrius agassizi (LeConte) (Black gooseberry borer) [Coleoptera: Cerambycidae] Immature/Adult Guild: Root,stem borer/?

5687 Zelleria gracilariella Busck [Lepidoptera: Yponomeutidae]

5688 Amphorophora lactucae (Kaltenbach) [Homoptera: Aphididae]

5689 Trialeurodes diasemus (Bemis) (Snowberry whitefly) [Homoptera: Aleyrodidae]

5690 Orthezia nigrocincta Cockerell [Homoptera: Ortheziidae]

5691 Anaphothrips arizonensis (Morgan) (Arizona cotton thrips) [Thysanoptera: Thripidae]

5692 Phymatodes fasciapilosus Van Dyke [Coleoptera: Cerambycidae] Immature/Adult Guild: Stem borer/?

5693 Pholus achemon (Drury) (Achemon sphinx) [Lepidoptera: Sphingidae] Overwintering Stage: Pupae in soil Oviposition Medium: Leaf uppersides

5694 Alpyia octomaculata (Fabricius) (Eight-spotted forester) [Lepidoptera: Agaristidae]

5695 Harrisiana brillians B. & McD. (Western grape skeletonizer) [Lepidoptera: Pyromorphidae] Immature/Adult Guild: Skeletonizer/?

5696 Harrisiana coracina Clemens (Western grape skeletonizer) [Lepidoptera: Pyromorphidae] Immature/Adult Guild: Skeletonizer/?

5697 Harrisiana metallica Stretch (Western grape skeletonizer) [Lepidoptera: Pyromorphidae] Immature/Adult Guild: Skeletonizer/?

5698 Desmia funeralis Hubner (Grape leaf folder) [Lepidoptera: Pyralidae] Overwintering Stage: Pupae Oviposition Medium: Leaf undersides Generations Per Year: 2

5699 Pterophorus delawaricus (Zeller) (Wild grape plume moth) [Lepidoptera: Pterophoridae]

5700 Coptodisca arbutiella Busck (Madrona shield bearer) [Lepidoptera: Heliozelidae]

5701 Spermophagus vitis Schaeffer (Wild grape seed weevil) [Coleoptera: Bruchidae] Immature/Adult Guild: Internal seed feeder/?

5702 Anuraphis bakeri (Cowen) (Clover aphid) [Homoptera: Aphididae]

5703 Anuraphis crataegifoliae (Fitch) (Hawthorn aphid) [Homoptera: Aphididae]

5704 Eriosoma lanigera (Hausmann) (Woolly apple aphid) [Homoptera: Aphididae]

5705 Lecanium pruinosum Coquillett (Frosted scale) [Homoptera: Coccidae]

5706 Saperda candida Fabricius (Round-headed apple tree borer) [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer: live wood/? Oviposition Medium: Bark incisions Generations Per Year: 1/3

5707 Anisandrus dispar (Fabricius) (European shot hole borer) [Coleoptera: Scolytidae] Immature/Adult Guild: Ambrosia beetle/Ambrosia beetle

5708 Strymon melinus (Hubner) (Bean lycaenid) [Lepidoptera: Lycaenidae] Immature/Adult Guild: Fruit,leaf feeder/?

5709 Spilonota ocellana (Denis & Schiffermuller) (Bud moth) [Lepidoptera: Olethreutidae] Immature/Adult Guild: Bud,leaf feeder/? Overwintering Stage: Larvae Oviposition Medium: Leaf undersides

5710 Carpocapsa pomonella (Linnaeus) (Codling moth) [Lepidoptera: Olethreutidae] Immature/Adult Guild: Fruit,leaf feeder/? Overwintering Stage: Larvae in bark crevices Oviposition

Medium: Leaf,fruit,twig surfaces
Generations Per Year: 2-4

5711 Pseudococcus longispinus (Targioni) (Long-tailed mealybug) [Homoptera: Pseudococcidae]

5712 Polyhymno acaciella Busck (Huisache moth) [Lepidoptera: Gelechiidae]
Immature/Adult Guild: Leaf feeder/?

5713 Orothrips kelloggi yosemiti Moulton (Kellogg's thrips) [Thysanoptera: Aeolothripidae]

5714 Taeniopteryx nigripennis Banks (Balck-winged stonefly) [Plecoptera: Nemouridae]

5715 Taeniopteryx banksi Needham & Claassen [Plecoptera: Nemouridae]

5716 Illinoia macrosiphum Wilson [Homoptera: Aphididae]

5717 Myzus ribifolii Davidson [Homoptera: Aphididae]

5718 Myzus houghtonensis (Troop) [Homoptera: Aphididae]

5719 Trialeurodes corollis (Penny) [Homoptera: Aleyrodidae]

5720 Euphyllura arctostaphyli Schwartz (Manzanita psyllid) [Homoptera: Psyllidae]

5721 Amphorophora nervatum (Gillette) (Wild rose aphid) [Homoptera: Aphididae]

5722 Aleuroplatus coronatus (Quaintance) (Crown whitefly) [Homoptera: Aleyrodidae]

5723 Aleuroparadoxus iridescens (Bemis) (Iridescent whitefly) [Homoptera: Aleyrodidae]

5724 Trialeurodes merlini (Bemis) (Cottony manzanita whitefly) [Homoptera: Aleyrodidae]

5725 Tetraleurodes splendens (Bemis) (Splendid whitefly) [Homoptera: Aleyrodidae]

5726 Trialeurodes hutchingsi (Bemis) (Hutchings's whitefly) [Homoptera: Aleyrodidae]

5727 Hylemya antiqua Meigen [Diptera: Anthomyiidae]

5728 Scatophaga stercorarium (Linnaeus) [Diptera: Anthomyiidae]

5729 Callithea spp. [Diptera: Anthomyiidae]

5730 Calliphora spp. [Diptera: Calliphoridae]

5731 Calliphora vicina [Diptera: Calliphoridae]

5732 Coenosia spp. [Diptera: Muscidae]

5733 Ravinia planifera (Aldrich) [Diptera: Sarcophagidae]

5734 Steveniopsis spp. [Diptera: Tachinidae]

5735 Archytas spp. [Diptera: Tachinidae]

5736 Ceracia spp. [Diptera: Tachinidae]

5737 Hyalomyodes spp. [Diptera: Tachinidae]

5738 Hyalomyia triangulifer (Lw.) [Diptera: Tachinidae]

5739 Senotainia spp. [Diptera: Sarcophagidae]

5740 Elphia spp. [Diptera: Tachinidae]

5741 Guerinia dydas Walker [Diptera: Tachinidae]

5742 Micromintha spp. [Diptera: Tachinidae]

5743 Erynnia tortricis (Coquillett) [Diptera: Tachinidae]

5744 Oxynops spp. [Diptera: Tachinidae]

5745 Neoclytus conjunctus (LeConte) [Coleoptera: Cerambycidae]

5746 Samia euryalus (Boisduvall) (Ceanothus silk moth) [Lepidoptera: Saturniidae] Overwintering Stage: Pupae
Generations Per Year: 1

5747 Poecilotettix pantherinus (Walker) (Military grasshopper) [Orthoptera: Acrididae]

5748 Reticulitermes humilis Banks (Obscure termite) [Isoptera: Termitidae]

5749 Icerya rileyi Cockerell [Homoptera: Margarodidae]

5750 Euryopthalmus succinctus (Linnaeus) [Hemiptera: Pyrrhocoridae]

5751 Dendrobiella sericans (LeConte) [Coleoptera: Bostrichidae]
Immature/Adult Guild: Wood borer: dead wood/?

5752 Amphicerus teres Horn [Coleoptera: Bostrichidae] Immature/Adult Guild: Bud,twig borer/?

5753 Megacyllene antennatus (White) (Round-headed mesquite borer) [Coleoptera: Cerambycidae]

5754 Schizax senex LeConte [Coleoptera: Cerambycidae] Immature/Adult Guild: Wood borer: dead wood/?

5755 Pachybrachis prosopis Fall [Coleoptera: Chrysomelidae]

5756 Aegeria prosopis Henry Edwards [Lepidoptera: Sesiidae] Immature/Adult Guild: Gall exploiter/?

5757 Mylabris uniformis LeConte (Desert weevil) [Coleoptera: Bruchidae]

5758 Mylabris protractus (Horn) [Coleoptera: Bruchidae]

5759 Aspidiotus candidulus Cockerell [Homoptera: Diaspididae]

5760 Lecanium persicae (Fabricius) (Peach scale) [Homoptera: Coccidae]

5761 Corythucha ciliata (Say) (Sycamore lacebug) [Hemiptera: Tingidae]

5762 Bombyx mori Linnaeus (Chinese or mulberry silkworm) [Lepidoptera: Bombycidae]

5763 Euzophera semifuneralis (Walker) (American plum borer) [Lepidoptera: Pyralidae]

5764 Aleuroplatus gelatinosus (Cockerell) (Gelatinous whitefly) [Homoptera: Aleyrodidae]

5765 Neuroterus saltatorius (Edwards) (Jumping oak galls) [Hymenoptera: Cynipidae]

5766 Plusiotis beyeri Skinner (Silver beetle) [Coleoptera: Scarabaeidae]

5767 Dryophanta glabra Gillette [Hymenoptera: Cynipidae] Immature/Adult Guild: Gall former: leaves/?

5768 Dryophanta porterae Cockerell [Hymenoptera: Cynipidae] Immature/Adult Guild: Gall former: leaves/?

5769 Kalotermes occidentis (Walker) (Occidental termite) [Isoptera: Kalotermitidae]

5770 Kalotermes minor (Hagen) (Minor termite) [Isoptera: Kalotermitidae]

5771 Arytaina ceanothae Crawford (Ceanothus psyllid) [Homoptera: Psyllidae]

5772 Pulvinaria coulteri Cockerell [Homoptera: Coccidae]

5773 Dichelonyx testaceipennis (Fall) [Coleoptera: Scarabaeidae]

5774 Haltica probata Fall (Rose flea beetle) [Coleoptera: Chrysomelidae]

5775 Diplolepsis bassetti Beutenmuller [Hymenoptera: Cynipidae] Immature/Adult Guild: Gall former: twigs/?

5776 Diplolepsis politus (Ashmead) [Hymenoptera: Cynipidae] Immature/Adult Guild: Gall former: stems/?

5777 Aphis ramonae Linnaeus (Black sage aphid) [Homoptera: Aphididae]

5778 Eriococcus poenulatus Ferris [Homoptera: Ortheziidae]

5779 Aphis albipes Oestlund (Snowberry aphid) [Homoptera: Aphididae]

5780 Aphis pulverulans Gillette [Homoptera: Aphididae]

5781 Sphinx vancouverensis Henry Edwards (Vancouver sphinx) [Lepidoptera: Sphingidae]

5782 Dialeurodes citri Riely & Howard (Citrus whitefly) [Homoptera: Aleyrodidae]

5783 Sphinx chersis (Hubner) (Chersis sphinx) [Lepidoptera: Sphingidae]

5784 Samia cecropia (Linnaeus) (Cecropia moth) [Lepidoptera: Saturniidae] Immature/Adult Guild: Leaf feeder/?

5785 Haplothrips leucanthemi (Schrank) (Statice thrips) [Thysanoptera: Phlaeothripidae]

5786 Brachyrhinus sulcatus (Fabricius) (Black vine weevil, cyclamen borer) [Coleoptera: Curculionidae]

5787 Calophya californica Schwarz (Sumac psyllid) [Homoptera: Psyllidae]

5788 Calophya triozomima Schwarz [Homoptera: Psyllidae]

5789 Liosomaphis rhois (Monell) [Homoptera: Aphididae]

5790 Pseudococcus longisetosus Ferris [Homoptera: Pseudococcidae]

5791 Saissetia hemisphaerica (Targioni) [Homoptera: Coccidae]

5792 Podosesia syringe (Harris) [Lepidoptera: Sesiidae] Immature/Adult Guild: Wood borer/?

5793 Trypeta baccharis Coquillett (Baccharis gall fly) [Diptera: Tephritidae] Immature/Adult Guild: Gall former: stems/?

5794 Aegeria tipuliformis (Linnaeus) (Imported currant borer) [Lepidoptera: Sesiidae] Immature/Adult Guild: Root,stem borer/? Overwintering Stage:

Larvae in stems Oviposition Medium: Bark crevices

5795 Melittia gloriosa Henry Edwards (Man root borer) [Lepidoptera: Sesiidae]

5796 Heliothrips haemorrhoidalis (Bouche) (Greenhouse thrips) [Thysanoptera: Thripidae]

5797 Pseudococcus erigoni Ehrhorn (Eriogonum mealybug) [Homoptera: Pseudococcidae]

5798 Corythucha eriodictyonae Osborn & Drake (Yerba santa lacebug) [Hemiptera: Tingidae]

5799 Coelopoeta glutinosi Walsingham (Yerba santa gall moth) [Lepidoptera: Elachistidae] Immature/Adult Guild: Gall former: leaves/?

5800 Termopsis laticeps Banks (White-headed termite) [Isoptera: Kalotermitidae]

5801 Frankliniella insularis (Franklin) (Isular thrips) [Thysanoptera: Thripidae]

5802 Ceresa basalis Walker (Basal treehopper) [Homoptera: Membracidae]

5803 Stictocephala pacifica Van Duzee (Pacific treehopper) [Homoptera: Membracidae]

5804 Stictocephala wickhami Van Duzee (Wickham's treehopper) [Homoptera: Membracidae]

5805 Idiocerus alternatus Fitch [Homoptera: Cicadellidae]

5806 Idiocerus pallidus Van Duzee [Homoptera: Cicadellidae]

5807 Idiocerus suturalis Fitch [Homoptera: Cicadellidae]

5808 Cicadella hieroglyphica (Say) (Hieroglyphic sharpshooter) [Homoptera: Cicadellidae]

5809 Helochara communis Fitch (Bog leafhopper) [Homoptera: Cicadellidae]

5810 Trioza maura Forster (Common willow psyllid) [Homoptera: Psyllidae]

5811 Trioza nigrilla Crawford (Black willow psyllid) [Homoptera: Psyllidae]

5812 Ceropsylla californica Crawford [Homoptera: Psyllidae]

5813 Psylla americana Crawford (American psyllid) [Homoptera: Psyllidae]

5814 Phylloxera salicola Pergande [Homoptera: Phylloxeridae]

5815 Pterochlorus viminalis (Fonscolombe) (Giant willow aphid) [Homoptera: Aphididae]

5816 Symydobius macrostachyae Essig [Homoptera: Aphididae]

5817 Symydobius salicicorticis Essig [Homoptera: Aphididae]

5818 Chaitophorus monella (Essig) [Homoptera: Aphididae]

5819 Melanoxantherium flocculosum (Weed) [Homoptera: Aphididae]

5820 Aspidiotus aesculi Johnson (Buckeye scale) [Homoptera: Diaspididae]

5821 Corythucha salicis Osborn & Drake (Eastern willow tingid) [Hemiptera: Tingidae]

5822 Phyllophaga fusca (Froelich) (Common June beetle) [Coleoptera: Scarabaeidae]

5823 Phyllophaga rugosa (Melsh.) [Coleoptera: Scarabaeidae]

5824 Cotalpa subcribrata Wickham [Coleoptera: Scarabaeidae]

5825 Sinodendron rugosum Mann. (Rugose stag beetle) [Coleoptera: Lucanidae] Immature/Adult Guild: Wood borer: decayed wood/?

5826 Amitermes californicus Banks (California termite) [Isoptera: Termitidae]

5827 Tibicen montezuma (Distant) (Montezuma cicada) [Homoptera: Cicadidae]

5828 Pachybrachis donneri Crotch [Coleoptera: Chrysomelidae]

5829 Pachybrachis livens LeConte [Coleoptera: Chrysomelidae]

5830 Disonycha quinquevittata (Say) (Five-striped willow beetle) [Coleoptera: Chrysomelidae]

5831 Disonycha pennsylvanica (Illiger) [Coleoptera: Chrysomelidae]

5832 Rhynchites cyanellus LeConte [Coleoptera: Curculionidae]

5833 Dasyneura leguminicola (Lintner) (Clover flower midge) [Diptera: Cecidomyiidae] Oviposition Medium: Flowers

5834 Atherix spp. (Snipe flies) [Diptera: Rhagionidae]

5835 Aglais antiopa (Linnaeus) (Mourning cloak) [Lepidoptera: Nymphalidae] Oviposition Medium: Branch surfaces

5836 Basilarchia lorquini (Boisduvall) (Lorquin's admiral) [Lepidoptera: Nymphalidae] Overwintering Stage: Larvae Generations Per Year: 2

5837 Smerinthus cerisyi (Kirby) (Cerisy's spinx) [Lepidoptera: Sphingidae]

5838 Pachysphinx modesta (Harris) (Poplar hawk moth) [Lepidoptera: Sphingidae]

5839 Telea polyphemus (Cramer) (Polyphemus silk moth) [Lepidoptera: Saturniidae]

5840 Catocala californica Edwards [Lepidoptera: Noctuidae]

5841 Sabulodes forficaria Guenee [Lepidoptera: Geometridae]

5842 Oiketicus townsendi Cockerell (Tornillo bagworm) [Lepidoptera: Geometridae]

5843 Alcathae apiformis (Clerck) (Hornet moth) [Lepidoptera: Sesiidae] Immature/Adult Guild: Wood borer/?

5844 Archips argyrospila Walker (Fruit tree leaf roller) [Lepidoptera: Tortricidae] Oviposition Medium: Bark surfaces

5845 Haploptilia volcki (Heinrich) (Volck's case bearer) [Lepidoptera: Coleophoridae]

5846 Pontania parva (Cresson) [Hymenoptera: Tenthredinidae]

5847 Pontania resinicola Marlatt (Resin colored sawfly) [Hymenoptera: Tenthredinidae]

5848 Pteronidea occidentalis Marlatt [Hymenoptera: Tenthredinidae]

5849 Cryptocampus macgillivray Rohwer [Hymenoptera: Tenthredinidae]

5850 Cryptocampus bebbianae Rohwer [Hymenoptera: Tenthredinidae]

5851 Toxoptera graminum Rondani (Green bug) [Homoptera: Aphididae]

5852 Diaspis piricola (Del Guercio) (Italian pear scale) [Homoptera: Diaspididae]

5853 Aleyrodes pruinosa Bemis (Pruinose whitefly) [Homoptera: Aleyrodidae]

5854 Corythucha incurvata Uhler (California Christmas berry tingid) [Hemiptera: Tingidae] Oviposition Medium: Leaf undersides

5855 Myzus rhamni (Fonscolombe) [Homoptera: Aphididae]

5856 Tetraleurodes stanfordi (Bemis) (Stanford whitefly) [Homoptera: Aleyrodidae]

5857 Prociphilus alnifoliae (Williams) [Homoptera: Aphididae]

5858 Trialeurodes wellmanae (Bemis) (Wellman's whitefly) [Homoptera: Aleyrodidae]

5859 Pachybrachis calidus Fall [Coleoptera: Chrysomelidae]

5860 Agrilus burkei Fisher [Coleoptera: Buprestidae]

5861 Syneta albida LeConte (Western fruit beetle) [Coleoptera: Chrysomelidae] Immature/Adult Guild: ?/Bud,flower,leaf feeder

5862 Erannis defoliaria Clerck (Mottled umber moth) [Lepidoptera: Geometridae] Immature/Adult Guild: Fruit,leaf feeder/? Overwintering Stage: Eggs Oviposition Medium: Bud,twig surfaces

5863 Alypia octomaculata (Fabricius) (Eight-spotted forester) [Lepidoptera: Agaristidae]

5864 Thrips physapus Linnaeus (European thrips) [Thysanoptera: Thripidae]

5865 Amphorophora rubicola (Oestlund) (Thimbleberry aphid) [Homoptera: Aphididae]

5866 Rhynchites bicolor viridilustrans Pierce (Rose curculio, rose snout beetle) [Coleoptera: Curculionidae] Immature/Adult Guild: ?/Bud,leaf feeder Overwintering Stage: Pupae Oviposition Medium: Fruit

5867 Olethreutes compestrana Zeller [Lepidoptera: Olethreutidae]

5868 Liothrips ilex dumosa (Moulton) (Christmas berry thrips) [Thysanoptera: Phlaeothripidae]

5869 Phyllaphis quercifoliae Gillette (Woolly oak aphid) [Homoptera: Aphididae]

5870 Hadronema militaris Uhler [Hemiptera: Miridae]

5871 Polydrusus ochreus (Fall) (Scrub oak weevil) [Coleoptera: Curculionidae]

5872 Andricus californicus (Bassett) (California gallfly) [Hymenoptera: Cynipidae] Immature/Adult Guild: Gall former: twigs/?

5873 Disholcaspis washingtonensis (Gillette) [Hymenoptera: Cynipidae]

Immature/Adult Guild: Gall former: twigs/?

5874 Disholcaspis eldoradensis (Beutenmuller) [Hymenoptera: Cynipidae] Immature/Adult Guild: Gall former: twigs/?

5875 Neuroterus decipiens Kinsey [Hymenoptera: Cynipidae] Immature/Adult Guild: Gall former: leaves/?

5876 Plagiotrichus chrysolepidicola diminuens Kinsey [Hymenoptera: Cynipidae] Immature/Adult Guild: Gall former: twigs/?

5877 Scyphophorus acupunctatus Gyll. [Coleoptera: Curculionidae] Immature/Adult Guild: Stem borer/Sap feeder

5878 Tegrodera erosa LeConte (Solider beetle) [Coleoptera: Meloidae]

5879 Tegrodera latecincta Horn (Solider beetle) [Coleoptera: Meloidae]

5880 Rhopalomyia baccharis Felt [Diptera: Cecidomyiidae]

5881 Reticulitermes humilis hoferi Banks [Isoptera: Termitidae] Immature/Adult Guild: Termite/Termite

5882 Stictomyia longicornis (Bigot) (Droop-winged fly) [Diptera: Otitidae] Immature/Adult Guild: Scavenger/?

5883 Arachnis picta Packard (Painted desert moth) [Lepidoptera: Arctiidae] Immature/Adult Guild: Leaf feeder/?

5884 Cryptocephalus sanguinicollis Suffrian [Coleoptera: Chrysomelidae] Immature/Adult Guild: ?/Leaf feeder

5885 Trichocellus rufierus Kirby [Coleoptera: Carabidae]

5886 Silis spp. [Coleoptera: Cantharidae]

5887 Delphacodes campestra [Homoptera: Delphacidae]

5888 Prokelisoides salina Ball [Homoptera: Delphacidae]

5889 Sogatella kolophon [Homoptera: Delphacidae]

5890 Cicada septendecim [Homoptera: Cicadidae]

5891 Diarthronomyia spp. [Diptera: Cecidomyiidae]

5892 Calophya triozoma Schwarz [Homoptera: Psyllidae]

5893 Pulverro spp. [Hymenoptera: Sphecidae]

5894 Astata bakeri Parker [Hymenoptera: Sphecidae]

5895 Diploplectron fossor Rohwer [Hymenoptera: Sphecidae]

5896 Philanthus boharti Ferg. [Hymenoptera: Sphecidae]

5897 Diodontus striatus Eigme. [Hymenoptera: Sphecidae]

5898 Podalonia spp. [Hymenoptera: Sphecidae]

5899 Eucerceris barri Scull. [Hymenoptera: Sphecidae]

5900 Belomicrus columbianus Kohl. [Hymenoptera: Sphecidae]

5901 Leptothorax muscorum [Hymenoptera: Formicidae]

5902 Formica occulta [Hymenoptera: Formicidae]

5903 Formica limata [Hymenoptera: Formicidae]

5904 Formica subsericea [Hymenoptera: Formicidae]

5905 Formica altipetens [Hymenoptera: Formicidae]

5906 Formica argentea [Hymenoptera: Formicidae]

5907 Trimorus spp. [Hymenoptera: Scelionidae]

5908 Gyron spp. [Hymenoptera: Scelionidae]

5909 Ceratochrysis collega R. Bohart [Hymenoptera: Chrysididae]

5910 Hedychridium panulum [Hymenoptera: Chrysididae]

5911 Parnopes edwardsii [Hymenoptera: Chrysididae]

5912 Boharticus spp. [Hymenoptera: Pteromalidae]

5913 Dibrachys carus [Hymenoptera: Pteromalidae]

5914 Dinarmus spp. [Hymenoptera: Pteromalidae]

5915 Chrysocharis spp. [Hymenoptera: Eulophidae]

5916 Chrysonotomyia spp. [Hymenoptera: Eulophidae]

5917 Dicladocerus spp. [Hymenoptera: Eulophidae]

5918 Paracrias arizonensis [Hymenoptera: Eulophidae]

5919 Idiostatus spp. [Orthoptera: Gryllidae]

5920 Cercyonis sthenele [Lepidoptera: Satyridae]

5921 Hesperia juba [Lepidoptera: Hesperiidae]

5922 Pseudanarta crocea [Lepidoptera: Noctuidae]

5923 Lestes spp. [Odonata: Lestidae]

5924 Coenagrionidae spp. [Odonata: Coenagrionidae]

5925 Megachile wheeleri Mitch. [Hymenoptera: Megachilidae]

5926 Melissodes rivalis Cresson [Hymenoptera: Anthophoridae]

5927 Andrena miserabilis Cresson [Hymenoptera: Andrenidae]

5928 Andrena taeniata Vier. [Hymenoptera: Andrenidae]

5929 Colletes spp. [Hymenoptera: Colletidae]

5930 Colletes fulgidus [Hymenoptera: Colletidae]

5931 Anthidium placitum Cresson [Hymenoptera: Megachilidae]

5932 Brachystropha spp. [Hymenoptera: Braconidae]

5933 Rogas spp. [Hymenoptera: Braconidae]

5934 Lysaphidius ramithyrus [Hymenoptera: Braconidae]

5935 Pseudamblyteles superbus [Hymenoptera: Ichneumonidae]

5936 Eutanyacra spp. [Hymenoptera: Ichneumonidae]

5937 Homotropus spp. [Hymenoptera: Ichneumonidae]

5938 Sinophorus spp. [Hymenoptera: Ichneumonidae]

5939 Diaparsis spp. [Hymenoptera: Ichneumonidae]

5940 Diplazon spp. [Hymenoptera: Ichneumonidae]

5941 Banchus spp. [Hymenoptera: Ichneumonidae]

5942 Acanthoscelides spp. [Coleoptera: Bruchidae]

5943 Amara musculis Say [Coleoptera: Carabidae]

5944 Bembidion obscurellum [Coleoptera: Carabidae]

5945 Bothrotes plumbeus x [Coleoptera: Tenebrionidae]

5946 Feltia spp. [Lepidoptera: Noctuidae]

5947 Poecilanthrax spp. [Diptera: Bombyliidae]

5948 Thyridanthrax spp. [Diptera: Bombyliidae]

5949 Dalmannia vitiosa [Diptera: Conopidae]

5950 Andrena vulpicolor Cockerell [Hymenoptera: Andrenidae]

5951 Andrena forbesii Rob. [Hymenoptera: Andrenidae]

5952 Cibolacris parviceps [Orthoptera: Acrididae]

5953 Psoloessa texana [Orthoptera: Acrididae]

5954 Clematodes larreae [Orthoptera: Acrididae]

5955 Ligurotettix coquilletti [Orthoptera: Acrididae]

5956 Aztecacris gloriosus [Orthoptera: Acrididae]

5957 Poecilotettix pantherina [Orthoptera: Acrididae]

5958 Poecilotettix longipennis [Orthoptera: Acrididae]

5959 Schistocerca albolineata [Orthoptera: Acrididae]

5960 Tanaocerus koebelei [Orthoptera: Acrididae]

5961 Anconia spp. [Orthoptera: Acrididae]

5962 Aeoloplides spp. [Orthoptera: Acrididae]

5963 Trimerotropis pallidipennis [Orthoptera: Acrididae]

5964 Bootettix argentatus [Orthoptera: Acrididae]

Insect Family Listing

This listing contains insect family and order names. Items in the listing are organized numerically and are located using the "Insect Order to Family Index" that follows in this section.

1 Nabidae (Hemiptera)

2 Anthocoridae (Hemiptera)

3 Miridae (Hemiptera)

4 Lygaeidae (Hemiptera)

5 Chrysopidae (Neuroptera)

6 Chrysomelidae (Coleoptera)

7 Thripidae (Thysanoptera)

8 Phlaeothripidae (Thysanoptera)

9 Aeolothripidae (Thysanoptera)

10 Sminthuridae (Collembola)

11 Poduridae (Collembola)

12 Onychiuridae (Collembola)

13 Entomobryidae (Collembola)

14 Isotomidae (Collembola)

15 Tetrigidae (Orthoptera)

16 Acrididae (Orthoptera)

17 Tridactylidae (Orthoptera)

18 Tettigoniidae (Orthoptera)

19 Gryllacrididae (Orthoptera)

20 Gryllidae (Orthoptera)

21 Gryllotalpidae (Orthoptera)

22 Phasmatidae (Orthoptera)

23 Mantidae (Orthoptera)

24 Blattidae (Orthoptera)

25 Blattellidae (Orthoptera)

26 Forficulidae (Dermaptera)

27 Labiduridae (Dermaptera)

28 Labiidae (Dermaptera)

29 Chelisochidae (Dermaptera)

30 Termitidae (Isoptera)

31 Kalotermitidae (Isoptera)

32 Rhinotermitidae (Isoptera)

33 Hodotermitidae (Isoptera)

34 Merothripidae (Thysanoptera)

35 Heterothripidae (Thysanoptera)

36 Corixidae (Hemiptera)

37 Notonectidae (Hemiptera)

38 Reduviidae (Hemiptera)

39 Phymatidae (Hemiptera)

40 Tingidae (Hemiptera)

41 Aradidae (Hemiptera)

42 Piesmatidae (Hemiptera)

43 Berytidae (Hemiptera)

44 Largidae (Hemiptera)

45 Pyrrhocoridae (Hemiptera)

46 Coreidae (Hemiptera)

47 Rhopalidae (Hemiptera)

48 Alydidae (Hemiptera)

49 Scutelleridae (Hemiptera)

50 Pentatomidae (Hemiptera)

51 Cydnidae (Hemiptera)

52 Corimelaenidae (Hemiptera)

53 Cicadidae (Homoptera)

54 Membracidae (Homoptera)

55 Cercopidae (Homoptera)

56 Cicadellidae (Homoptera)

57 Delphacidae (Homoptera)

58 Fulgoridae (Homoptera)

59 Flatidae (Homoptera)

60 Acanaloniidae (Homoptera)

61 Issidae (Homoptera)

62 Derbidae (Homoptera)

63 Cixiidae (Homoptera)

64 Kinnaridae (Homoptera)

65 Dictyopharidae (Homoptera)

66 Achilidae (Homoptera)

67 Tropiduchidae (Homoptera)

68 Psyllidae (Homoptera)

69 Aleyrodidae (Homoptera)
70 Aphididae (Homoptera)
71 Eriosomatidae (Homoptera)
72 Chermidae (Homoptera)
73 Phylloxeridae (Homoptera)
74 Margarodidae (Homoptera)
75 Ortheziidae (Homoptera)
76 Diaspididae (Homoptera)
77 Coccidae (Homoptera)
78 Aclerdidae (Homoptera)
79 Lacciferidae (Homoptera)
80 Asterolecaniidae (Homoptera)
81 Pseudococcidae (Homoptera)
82 Eriococcidae (Homoptera)
83 Dactylopiidae (Homoptera)
84 Kermidae (Homoptera)
85 Raphididae (Neuroptera)
86 Mantispidae (Neuroptera)
87 Hemerobiidae (Neuroptera)
88 Myrmeleontidae (Neuroptera)
89 Ascalaphidae (Neuroptera)
90 Rhysodidae (Coleoptera)
91 Cicindelidae (Coleoptera)
92 Carabidae (Coleoptera)
93 Histeridae (Coleoptera)
94 Staphylinidae (Coleoptera)
95 Pselaphidae (Coleoptera)
96 Ptiliidae (Coleoptera)
97 Leiodidae (Coleoptera)
98 Silphidae (Coleoptera)
99 Scaphidiidae (Coleoptera)
100 Helodidae (Coleoptera)
101 Dascillidae (Coleoptera)
102 Rhipiceridae (Coleoptera)
103 Lucanidae (Coleoptera)
104 Passalidae (Coleoptera)
105 Scarabaeidae (Coleoptera)
106 Byrrhidae (Coleoptera)
107 Buprestidae (Coleoptera)
108 Elateridae (Coleoptera)
109 Throscidae (Coleoptera)
110 Lampyridae (Coleoptera)
111 Cantharidae (Coleoptera)
112 Lycidae (Coleoptera)
113 Dermestidae (Coleoptera)
114 Anobiidae (Coleoptera)
115 Ptinidae (Coleoptera)
116 Bostrichidae (Coleoptera)
117 Lyctidae (Coleoptera)
118 Trogositidae (Coleoptera)
119 Cleridae (Coleoptera)
120 Melyridae (Coleoptera)
121 Nitidulidae (Coleoptera)
122 Rhizophagidae (Coleoptera)
123 Cucujidae (Coleoptera)
124 Cryptophagidae (Coleoptera)
125 Languriidae (Coleoptera)
126 Erotylidae (Coleoptera)
127 Phalacridae (Coleoptera)
128 Cerylonidae (Coleoptera)
129 Corylophidae (Coleoptera)
130 Coccinellidae (Coleoptera)
131 Endomychidae (Coleoptera)
132 Lathridiidae (Coleoptera)
133 Byturidae (Coleoptera)
134 Mycetophagidae (Coleoptera)
135 Ciidae (Coleoptera)
136 Monommidae (Coleoptera)
137 Colydiidae (Coleoptera)
138 Tenebrionidae (Coleoptera)
139 Lagriidae (Coleoptera)
140 Alleculidae (Coleoptera)

141 Salpingidae (Coleoptera)
142 Pyrochroidae (Coleoptera)
143 Othniidae (Coleoptera)
144 Mycteridae (Coleoptera)
145 Oedemeridae (Coleoptera)
146 Melandryidae (Coleoptera)
147 Mordellidae (Coleoptera)
148 Rhipiphoridae (Coleoptera)
149 Meloidae (Coleoptera)
150 Anthicidae (Coleoptera)
151 Pedilidae (Coleoptera)
152 Cerambycidae (Coleoptera)
153 Bruchidae (Coleoptera)
154 Anthribidae (Coleoptera)
155 Brentidae (Coleoptera)
156 Curculionidae (Coleoptera)
157 Platypodidae (Coleoptera)
158 Scolytidae (Coleoptera)
159 Pyralidae (Lepidoptera)
160 Pterophoridae (Lepidoptera)
161 Olethreutidae (Lepidoptera)
162 Tortricidae (Lepidoptera)
163 Cossidae (Lepidoptera)
164 Gelechiidae (Lepidoptera)
165 Oecophoridae (Lepidoptera)
166 Sesiidae (Lepidoptera)
167 Coleophoridae (Lepidoptera)
168 Gracilariidae (Lepidoptera)
169 Psychidae (Lepidoptera)
170 Incurvariidae (Lepidoptera)
171 Geometridae (Lepidoptera)
172 Drepanidae (Lepidoptera)
173 Arctiidae (Lepidoptera)
174 Agaristidae (Lepidoptera)
175 Noctuidae (Lepidoptera)
176 Notodontidae (Lepidoptera)
177 Liparidae (Lepidoptera)
178 Lasiocampidae (Lepidoptera)
179 Saturniidae (Lepidoptera)
180 Sphingidae (Lepidoptera)
181 Hesperiidae (Lepidoptera)
182 Lycaenidae (Lepidoptera)
183 Pieridae (Lepidoptera)
184 Papilionidae (Lepidoptera)
185 Parnassiidae (Lepidoptera)
186 Danaidae (Lepidoptera)
187 Satyridae (Lepidoptera)
188 Heliconiidae (Lepidoptera)
189 Nymphalidae (Lepidoptera)
190 Tipulidae (Diptera)
191 Psychodidae (Diptera)
192 Ptychopteridae (Diptera)
193 Dixidae (Diptera)
194 Chaoboridae (Diptera)
195 Culicidae (Diptera)
196 Ceratopogonidae (Diptera)
197 Chironomidae (Diptera)
198 Simuliidae (Diptera)
199 Anispodidae (Diptera)
200 Bibionidae (Diptera)
201 Mycetophilidae (Diptera)
202 Sciaridae (Diptera)
203 Scatopsidae (Diptera)
204 Cecidomyiidae (Diptera)
205 Xylophagidae (Diptera)
206 Xylomyidae (Diptera)
207 Stratiomyidae (Diptera)
208 Tabanidae (Diptera)
209 Rhagionidae (Diptera)
210 Therevidae (Diptera)
211 Mydidae (Diptera)
212 Asilidae (Diptera)

213 Leptogastridae (Diptera)

214 Bombyliidae (Diptera)

215 Empididae (Diptera)

216 Dolichopodidae (Diptera)

217 Lonchopteridae (Diptera)

218 Phoridae (Diptera)

219 Pipunculidae (Diptera)

220 Syrphidae (Diptera)

221 Conopidae (Diptera)

222 Micropezidae (Diptera)

223 Psilidae (Diptera)

224 Otitidae (Diptera)

225 Platystomatidae (Diptera)

226 Tephritidae (Diptera)

227 Coelopidae (Diptera)

228 Sepsidae (Diptera)

229 Sciomyzidae (Diptera)

230 Lauxaniidae (Diptera)

231 Chamaemyiidae (Diptera)

232 Piophilidae (Diptera)

233 Sphaeroceridae (Diptera)

234 Milichiidae (Diptera)

235 Chloropidae (Diptera)

236 Agromyzidae (Diptera)

237 Clusiidae (Diptera)

238 Heleomyzidae (Diptera)

239 Anthomyzidae (Diptera)

240 Anthomyiidae (Diptera)

241 Muscidae (Diptera)

242 Calliphoridae (Diptera)

243 Sarcophagidae (Diptera)

244 Tachinidae (Diptera)

245 Argidae (Hymenoptera)

246 Cimbicidae (Hymenoptera)

247 Tenthredinidae (Hymenoptera)

248 Siricidae (Hymenoptera)

249 Cephidae (Hymenoptera)

250 Braconidae (Hymenoptera)

251 Ichneumonidae (Hymenoptera)

252 Mymaridae (Hymenoptera)

253 Trichogrammatidae (Hymenoptera)

254 Eulophidae (Hymenoptera)

255 Encyrtidae (Hymenoptera)

256 Eupelmidae (Hymenoptera)

257 Perilampidae (Hymenoptera)

258 Torymidae (Hymenoptera)

259 Pteromalidae (Hymenoptera)

260 Eurytomidae (Hymenoptera)

261 Chalcididae (Hymenoptera)

262 Figitidae (Hymenoptera)

263 Cynipidae (Hymenoptera)

264 Evaniidae (Hymenoptera)

265 Gasteruptiidae (Hymenoptera)

266 Aulacidae (Hymenoptera)

267 Pelecinidae (Hymenoptera)

268 Proctotrupidae (Hymenoptera)

269 Diapriidae (Hymenoptera)

270 Scelionidae (Hymenoptera)

271 Platygasteridae (Hymenoptera)

272 Chrysididae (Hymenoptera)

273 Bethylidae (Hymenoptera)

274 Dryinidae (Hymenoptera)

275 Tiphiidae (Hymenoptera)

276 Mutillidae (Hymenoptera)

277 Scoliidae (Hymenoptera)

278 Formicidae (Hymenoptera)

279 Vespidae (Hymenoptera)

280 Pompilidae (Hymenoptera)

281 Sphecidae (Hymenoptera)

282 Colletidae (Hymenoptera)

283 Halictidae (Hymenoptera)

284 Andrenidae (Hymenoptera)

285 Megachilidae (Hymenoptera)
286 Anthophoridae (Hymenoptera)
287 Apidae (Hymenoptera)
288 Ephydridae (Diptera)
289 Yponomeutidae (Lepidoptera)
290 Aspidiinae (Lepidoptera)
291 Sphegigastrinae (Hymenoptera)
292 Dasytidae (Coleoptera)
293 Trixoscelididae (Diptera)
294 Oelolothripidae (Thysanoptera)
295 Aphidiidae (Thysanoptera)
296 Ceraphronidae (Hymenoptera)
297 Cynipoidea (Hymenoptera)
298 Psocidae (Psocoptera)
299 Eucoilidae (Hymenoptera)
300 Carnidae (Diptera)
301 Anaspidiinae (Misc. Arthropoda)
302 Neelidae (Collembola)
303 Elasmidae (Hymenoptera)
304 Thysanidae (Hymenoptera)
305 Eutrichosomatidae (Hymenoptera)
306 Eucharitidae (Hymenoptera)
307 Eumenidae (Hymenoptera)
308 Microlepidoptera (Lepidoptera)
309 Ethmiidae (Lepidoptera)
310 Diprionidae (Hymenoptera)
311 Xyelidae (Hymenoptera)
312 Nemouridae (Pleccptera)
313 Coccoidea (Homoptera)
314 Scenopinidae (Diptera)
315 Lyonetiidae (Lepidoptera)
316 Drosophilidae (Diptera)
317 Scythridae (Lepidoptera)
318 Dytiscidae (Coleoptera)
319 Malachiidae (Coleoptera)
320 Tethinidae (Diptera)
321 Asteidae (Diptera)
322 Lymantriidae (Lepidoptera)
323 Polyphagidae (Orthoptera)
324 Nepticulidae (Lepidoptera)
325 Pseudocaeciliidae (Psocoptera)
326 Trogiidae (Psocoptera)
327 Bittacidae (Mecoptera)
328 Phaloniidae (Lepidoptera)
329 Oinophilidae (Lepidoptera)
330 Tischeriidae (Lepidoptera)
331 Leucospididae (Hymenoptera)
332 Urothripidae (Thysanoptera)
333 Sapygidae (Hymenoptera)
334 Coniopterygidae (Neuroptera)
335 Perlodidae (Plecoptera)
336 Libellulidae (Odonata)
337 Coenagrionidae (Odonata)
338 Chyromyidae (Diptera)
339 Hepialidae (Lepidoptera)
340 Blastobasidae (Lepidoptera)
341 Walshiidae (Lepidoptera)
342 Lepismatidae (Thysanura)
343 Tineidae (Lepidoptera)
344 Odiniidae (Diptera)
345 Ormyridae (Hymenoptera)
346 Lonchaeidae (Diptera)
347 Oxaeidae (Hymenoptera)
348 Melittidae (Hymenoptera)
349 Riodinidae (Lepidoptera)
350 Lestidae (Odonata)
351 Acroceridae (Diptera)
352 Pallopteridae (Diptera)
353 Sierolomorphidae (Hymenoptera)
354 Timemidae (Orthoptera)
355 Pyromorphidae (Lepidoptera)
356 Heliozelidae (Lepidoptera)
357 Bombycidae (Lepidoptera)
358 Elachistidae (Lepidoptera)

Insect Family to Insect Index

This index is organized alphabetically by insect family name. Bracketed numbers following the names are listing numbers found in the "Insect Family Listing." For example, the family Acanaloniidae, which is followed by the bracketed number "[60]," can be found in the "Insect Family Listing" as record number 60. Numbers not contained in brackets are listing numbers found in the "Insect Listing."

Acanaloniidae [60] 183 184 1292

Achilidae [66] 1298

Aclerdidae [78] 1310

Acrididae [16] 586 1205 1206 1207 1208 1209 1210 1211 1212 1213 1214 1215 1216 1217 1218 1219 1248 1660 1661 1662 1663 1701 1719 1720 1721 1767 1774 1775 1776 1778 1779 1780 1781 1795 1796 1797 1798 1799 1800 1801 1802 1803 1818 1819 1820 1821 1822 1823 1834 1837 1838 1839 1840 2004 2525 2673 2674 2675 2676 2735 2745 2767 2783 2807 2808 2809 2810 2811 2812 2813 2814 2815 2816 2823 2824 2825 2826 2830 2831 2832 2833 2849 2850 2851 2852 2853 2854 2855 2856 2891 2892 2893 2894 2895 2896 2897 2903 3101 3102 3453 3454 3455 3456 3742 3743 3893 3926 3927 3928 3929 3930 3931 3932 3933 3934 3935 3936 3937 3938 3939 3940 3941 3942 3943 3944 3945 3946 3947 3948 4397 4521 4522 4523 4578 4593 4652 4653 5105 5106 5747 5952 5953 5954 5955 5956 5957 5958 5959 5960 5961 5962 5963 5964

Acroceridae [351] 5264

Aeolothripidae [9] 19 45 46 1241 3894 5587 5597 5623 5631 5682 5713

Agaristidae [174] 1406 5694 5863

Agromyzidae [236] 488 508 509 688 1468 1885 1886 1887 2705 3090 3186 3187 3188 3189 3190 3191 3591 3597 4394 4428 4429 4430 4431 4432 4477 4677 4678 4679 4680 4681 5617

Aleyrodidae [69] 1301 1554 1755 2972 2974 2975 4366 4449 5579 5614 5615 5625 5626 5668 5669 5670 5689 5719 5722 5723 5724 5725 5726 5764 5782 5853 5856 5858

Alleculidae [140] 48 1372 3044

Alydidae [48] 1280

Andrenidae [284] 255 256 257 258 902 903 904 905 906 907 908 909 1516 1718 1965 3498 3499 3500 3501 3502 3503 3504 3505 3506 4515 4888 4889 4890 4891 4892 4893 4894 4895 4896 4897 4898 4899 4900 4901 5474 5475 5477 5478 5479 5480 5481 5482 5493 5927 5928 5950 5951

Anispodidae [199] 1431

Anobiidae [114] 49 50 1346 1556 1568 1582 1602 1634 1635 1804 3046 3909 3910 5627

Anthicidae [150] 51 52 53 523 1382 1841 3023 3155

Anthocoridae [2] 5 379 380 928 1234

Anthomyiidae [240] 139 469 584 634 1472 3722 4484 4485 4486 4501 4516 5302 5303 5305 5306 5307 5308 5309 5310 5311 5312 5313 5727 5728 5729

Anthomyzidae [239] 1471

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Sap feeder 189 190 925 933 934 1003 1300 1302 1622 1633 1757 1940 2187 2310 2463 2466 2565 2599 2645 2708 2763 2768 2772 2773 2875 2876 2877 2881 2882 2906 2916 2917 3104 3105 3106 3107 3157 3168 3174 4077
Sap feeder: bark 4108
Sap feeder: buds,leaves,shoots 5624
Sap feeder: leaves 2056
Sap feeder: leaves,limbs,twigs 2600
Sap feeder: leaves,stems 5589
Sap feeder: shoots 2157
Saprophage 636 743 945 1119 1243 1244

1245 1246 1331 1335 1356 1358 1361 1424 1431 1435 1449 1469 1470 1700 2527
Scavenger 1428 1464 1465 4336 5882
Seed feeder 1236 1277 3910
Seed pod feeder 3822 3825 3827 3832
Seed,seedling feeder 469
Seedling,root feeder 1876
Skeletonizer 78 386 1075 1076 2235 2357 2358 2469 2625 3684 3712 4185 5695 5696 5697
Stem borer 1231 1357 1481 1610 2522 2688 2771 2774 3769 3770 3771 3823 3824 3829 3831 3896 3911 3912 3913 3914 3915 4007 4425 5595 5692 5877
Stem borer: dead stems 5620
Stem feeder 243 247 1202 1953 2508 2654 4372 4373 4374 4375 4384 4406 4410 4412 4413 4419 4437 4459 4587 4591
Termite 2762 4009 4010 5593 5881
Wood borer 30 408 1232 1336 1339 1348 1349 1384 1480 1543 1644 1645 1784 1807 1828 2521 2545 2546 2547 2548 2549 2550 2592 2728 2730 2742 2761 2764 2822 2844 2848 2902 3670 3671 3673 3674 3675 3764 3765 3780 3781 3782 3783 3784 3786 3787 3788 3789 3790 3791 3792 3793 3794 3795 3796 3797 3798 3799 3800 3801 3802 3803 3804 3805 3806 3807 3808 3809 3810 3811 3812 3813 3814 3815 3816 3817 3818 3819 3820 4170 4171 4172 4173 4178 4179 4180 4181 4184 4223 4224 4225 4226 4227 4228 4229 4230 4231 4289 4326 5580 5581 5629 5651 5792 5843
Wood borer,girdler 1541 1616 2736 2819 2820 2821
Wood borer: dead wood 1617 1641 1814 3042 3047 4148 4177 4329 5627 5628 5656 5751 5754
Wood borer: dead,injured wood 1561 1569 2692 4328 4331
Wood borer: decayed wood 5825
Wood borer: injured wood 3785
Wood borer: live wood 410 416 2687 3696 5641 5684 5706

Adult Guild to Insect Index

This index is organized alphabetically by insect guild. Numbers in this index are listing numbers found in the "Insect Listing."

Ambrosia beetle 4174 4175 4176 5707
Animal disease vector 2834
Aphid farmer 270 397 398 2552
Bark beetle 411 1549 1612 1640 3672 3691 3692 3693 3695 4167 4169 4187
Bark feeder 3103
Bark,leaf feeder 1561 1784 2742
Blood feeder 1427 1430 1440 1700 2370
Bud feeder,leaf perforator 2625
Bud,flower feeder 859 1876 2313 5591
Bud,flower,leaf feeder 41 3480 5585 5861
Bud,leaf feeder 5866
Bud,leaf,seed feeder 1235
Bud,leaf,stem feeder 4692
Bud,leaf,twig feeder 1558
Bud,seed feeder 6 38 1667
Cactus joint feeder 2774 3124
Carrion feeder 1330
Crown feeder 4471
Crown,root,stem feeder 4376
Dead stem borer 1188 3949
Defoliator,seed eater 1793
Ectoparasite,blood feeder 1428
Epidermal feeder 3296
Flower feeder 2 1384 1433 3894 3895 4336 4387
Flower,fruit feeder 2849 2850 5655
Flower,fruit,leaf feeder 365
Flower,leaf feeder 92 1238 2366 2521 2736 3095 4414 4444 4460 4462
Flower,leaf,stem feeder 4364 4393
Fruit feeder 18 1119 3845 3950 3961
Fruit,leaf feeder 2778
Fungus feeder 1363 1366 1367
Fungus feeder,saprophage 1273
Gall former 466 505 723 725 953 1908 1910 1913 2479 2480 2481 2737 2741
Girdler 1541 1616 4148
Leaf feeder 90 207 209 221 225 341 343 404 626 1208 1211 1212 1248 1250 1252 1254 1272 1274 1288 1405 1552 1557 1662 1663 1719 1724 1853 1928 1941 2227 2247 2284 2357 2358 2359 2626 2735 2740 2765 2766 2767 2783 2829 2830 2831 2832 2833 2845 2846 2851 2852 2853 2854 2855 2856 2888 2889 2890 2891 2892 2893 2894 2895 2896 2897 2898 2899 2903 2924 2925 2961 2966 3096 3097 3101 3102 3649 3676 3742 3743 3893 3902 3903 3904 3905 3907 3908 3916 3926 4288 4362 4363 4369 4388 4390 4391 4392 4397 4398 4402 4403 4405 4407 4408 4409 4411 4421 4423 4424 4425 4426 4427 4435 4440 4445 4449 4451 4452 4586 4588 4592 4593 5603 5680 5884
Leaf perforator 78 1075 1076 2469
Leaf,pollen,seed feeder 822
Leaf,stem feeder 24 181 182 227 371 376 1749 1919 1935 2112 3906 4365 4370 4371 4389 4399 4400 4401 4404 4433 4434 4443 4453 4465 4466 4468 4469
Leafcutter bee 3729
Nectar feeder 164 945 951 2388 3100
Nectar,petal,pollen feeder 76 1074
Nectar,pollen feeder 32 2904 3511 3715 3716 3717 3718 3719 3722 3723 3724 3725 3726 3731 3732 3822 3826 3830
Oviposition damage 1231 1678
Petal feeder 3720
Plant disease vector 1703 2248 2926 2927
Pollen feeder 421 1728 3052 3727
Predator 5 7 11 19 26 115 322 326 473 622 710 727 837 838 844 845 1219 1233 1234 1255 1270 1318 1323 1324 1350 1351 1352 1355 1362 1373 1441 1443 1444 1448 1668 1671 1730 1742 1754 1859 1862 1863 2338 2632 2641 3185 5682
Root feeder 722 2176 5606
Root,stem feeder 4377
Sap feeder 189 190 925 933 934 1003 1300 1302 1622 1633 1757 1940 2187 2310 2463 2466 2565 2599 2645 2708 2768 2772 2773 2875 2876 2877 2881 2882 2906 2916 2917 3104 3105 3106 3107 3157 3168 3174 3730 4077 5595 5877
Sap feeder: bark 4108
Sap feeder: buds,leaves,shoots 5624
Sap feeder: leaves 2056
Sap feeder: leaves,limbs,twigs 2600
Sap feeder: leaves,stems 5589
Sap feeder: shoots 2157
Saprophage 743 1243 1244 1245 1246 1331 1356 1358 1361 2527
Seed feeder 1236 1277 3728 3910
Stem borer 3769 3896 3911
Stem feeder 243 247 1953 2508 2654 4372 4373 4374 4375 4406 4410 4412 4413 4437 4467 4470 4587
Termite 4009 4010 5593 5881
Wood borer 1336 1389 1390 1543 4184 5581

SECTION IV: PLANT INFORMATION

Plant Listing

This listing contains plant information. See "Description of the Sections" for details about the information included in the listing. Items in the listing are organized numerically and are located using one of the two indexes that follow in this section.

1 Acacia spp. Mill. (Acacia) [Leguminosae]

2 Acacia argustissima (Mill.)O. Ktze. (Prairie acacia) [Leguminosae]

3 Acacia constricta Bentham (Mescat acacia) [Leguminosae]

4 Acacia filicioides (Fernleaf acacia) [Leguminosae]

5 Acacia greggii A. Gray (Catclaw acacia) [Leguminosae]

6 Acacia senegal (Gumarabic acacia) [Leguminosae]

7 Acamptopappus spp. A. Gray (Goldenhead) [Compositae]

8 Acamptopappus sphaerocephalus (Harv. & Gray)A. Gray (Rayless goldenhead) [Compositae]

9 Acer spp. L. (Maple) [Aceraceae]

10 Acer glabrum douglassii Torr.(Hook.) (Douglas rocky mountain maple) [Aceraceae]

11 Acer grandidentatum Nuttall (Bigtooth maple) [Aceraceae]

12 Acer glabrum Torr. (Dwarf maple) [Aceraceae]

13 Acer ginnala Maxim. (Amur maple,tatarian maple) [Aceraceae]

14 Agave kaibabensis McKelvey (Kaibab agave) [Amaryllidaceae]

15 Alnus rhombifolia Nutt. (White alder,Sierra alder) [Betulaceae]

16 Alnus oblongifolia Torrey (New Mexico alder) [Betulaceae]

17 Agave spp. (Agave) [Amaryllidaceae]

18 Agave utahensis Engelm. (Utah agave) [Amaryllidaceae]

19 Agave parryi Engelmann (Parry agave) [Amaryllidaceae]

20 Alhagi spp. [Leguminosae]

21 Alhagi camelorum (Camelthorn) [Leguminosae]

22 Allenrolfea spp. Kuntze (Pickleweed) [Chenopodiaceae]

23 Allenrolfea occidentalis (Wats.)Ktze. (Iodine bush) [Chenopodiaceae]

24 Alnus spp. B. Ehrh. (Alder) [Betulaceae]

25 Amelanchier florida (Pacific serviceberry) [Rosaceae]

26 Ambrosia eriocentra Gray(Payne) (Woolly bursage) [Compositae]

27 Arctostaphylos parryana Lemmon [Ericaceae]

28 Ambrosia spp. (Bur-sage) [Compositae]

29 Ambrosia ambrosioides (Cavanilles)Payne [Compositae]

30 Ambrosia deltoidea (Torrey)Payne [Compositae]

31 Ambrosia dumosa Gray(Payne) (White bursage,burroweed,sandbur) [Compositae]

32 Amelanchier spp. (Serviceberry) [Rosaceae]

33 Amelanchier alnifolia Nuttall (Saskatoon serviceberry) [Rosaceae]
Primary Use(s): Browse,edible fruits
Palatability: Moderate to high

34 Amelanchier bakeri [Rosaceae]

35 Amelanchier goldinani [Rosaceae]

36 Amelanchier mormonica Schneider [Rosaceae]

37 Amelanchier oreophila A. Nels. (Mountain serviceberry) [Rosaceae]

38 Amelanchier utahensis Koehne (Utah serviceberry) [Rosaceae] Primary Use(s): Browse,edible fruits Palatability: High

39 Amorpha spp. (Amorpha) [Fabaceae]

40 Amorpha californica (California amorpha) [Fabaceae]

41 Amorpha canescens Pursh. (Leadplant amorpha) [Fabaceae]

42 Amorpha fruticosa L. (Indigobush amorpha) [Fabaceae]

43 Amphipappus spp. (Chaff-bush) [Compositae]

44 Amphipappus fremontii [Compositae]

45 Artemisia douglasiana Bess. [Compositae]

46 Alnus sinuata (Regel)Rhydb. [Betulaceae]

47 Artemisia papposa Blake & Cronq. [Compositae]

48 Arctostaphylos spp. (Manzanita) [Ericaceae] Primary Use(s): Small-mammal food Palatability: Minimal

49 Arctostaphylos menziesii [Ericaceae]

50 Arctostaphylos nevadensis Gray (Pinemat manzanita) [Ericaceae]

51 Arctostaphylos patula Greene (Greenleaf manzanita) [Ericaceae]

52 Arctostaphylos pungens H.B.K. (Paintleaf manzanita) [Ericaceae]

53 Arctostaphylos uva-ursi L. (Bearberry,kinnikinnick) [Ericaceae]

54 Artemisia spp. (Sagebrush/Wormwood) [Compositae]

55 Artemisia arbuscula Nutt. (Low sagebrush) [Compositae] Primary Use(s): Browse Palatability: Variable

56 Artemisia bigelovii (Bigelow sagebrush) [Compositae] Primary Use(s): Browse Palatability: High

57 Artemisia cana Pursh. (Silver sagebrush) [Compositae] Primary Use(s): Browse Palatability: High

58 Artemisia longiloba (Osterh.)Beetle (Alkali sagebrush) [Compositae]

59 Artemisia nova A. Nelson (Black sagebrush) [Compositae] Primary Use(s): Browse,revegetation Palatability: High

60 Artemisia pygmaea Gray (Pygmy sagebrush) [Compositae] Primary Use(s): Ground Cover Palatability: Low

61 Artemisia rigida (Nutt.)Gray (Stiff or scabland sagebrush) [Compositae] Primary Use(s): Ground Cover Palatability: Low

62 Artemisia rothrockii Gray (Timberline sagebrush) [Compositae] Primary Use(s): Browse Palatability: High

63 Artemisia tridentata Nuttall (Big sagebrush) [Compositae] Primary Use(s): Browse Palatability: High

64 Artemisia tridentata tridentata Nutt. (Basin big sagebrush) [Compositae]

65 Artemisia tridentata wyomingensis Beetle & Young (Wyoming big sagebrush) [Compositae]

66 Artemisia tridentata vaseyana (Rydb.)Beetle (Mountain big sagebrush) [Compositae]

67 Artemisia tripartita Rydberg (Threetip sagebrush) [Compositae] Palatability: Low

68 Artemisia abrotanum L. (Oldman wormwood) [Compositae] Primary Use(s): Variable Palatability: Variable

69 Artemisia absinthium (Common wormwood) [Compositae] Primary Use(s): Variable Palatability: Variable

70 Artemisia frigida Willd. (Fringed sagebrush) [Compositae] Primary Use(s): Browse,revegetation Palatability: Variable

71 Artemisia carruthii Wood ex Carruth (Carruth sagebrush) [Compositae]

72 Artemisia longifolia Nutt. (Longleaf or alkali sagebrush) [Compositae] Primary Use(s): Revegetation Palatability: Minimal

73 Artemisia ludoviciana Nuttall (Louisiana sagebrush) [Compositae]

74 Artemisia michauxiana Besser (Michaux sagebrush) [Compositae]

75 Artemisia dracunculus Pursh. (Tarragon) [Compositae]

76 Artemisia filifolia Torr. (Sand sagebrush) [Compositae] Primary Use(s): Browse Palatability: Variable

77 Artemisia pedatifida (Birdfoot sagebrush) [Compositae]

78 Artemisia spinescens (Bud sagebrush) [Compositae]

79 Atriplex spp. (Saltbush) [Chenopodiaceae]

80 Atriplex acanthocarpa [Chenopodiaceae]

81 Atriplex aptera A. Nels. [Chenopodiaceae]

82 Atriplex bonevillensis C.A. Hanson [Chenopodiaceae]

83 Atriplex canescens (Pursh)Nutt. (Fourwing saltbush) [Chenopodiaceae]

84 Atriplex confertifolia (Torr.& Frem.)Wats. (Shadscale) [Chenopodiaceae]

85 Atriplex corrugata S. Wats. (Mat saltbush) [Chenopodiaceae]

86 Atriplex cuneata (Nelson)H. & C. (Castle valley clover) [Chenopodiaceae]

87 Atriplex falcata Standley [Chenopodiaceae]

88 Atriplex gardneri (Mog.)Hull & Clements (Gardner saltbush) [Chenopodiaceae]

89 Atriplex garrettii Rydb. (Garrett saltbush) [Chenopodiaceae]

90 Atriplex hymenelytra (Desertholly saltbush) [Chenopodiaceae]

91 Atriplex laciniata [Chenopodiaceae]

92 Atriplex lentiformis (Torrey)Watson (Big saltbush) [Chenopodiaceae]

93 Atriplex linearis S. Watson [Chenopodiaceae]

94 Atriplex navajoensis C.A. Hanson [Chenopodiaceae]

95 Atriplex obovata Moq. (Broadscale saltbush) [Chenopodiaceae]

96 Atriplex polycarpa (Torrey)Watson (Cattle saltbush) [Chenopodiaceae]

97 Atriplex tridentata O. Ktze. [Chenopodiaceae]

98 Atriplex argentea Nuttall (Silverscale) [Chenopodiaceae]

99 Baccharis spp. (Baccharis) [Compositae]

100 Baccharis emoryi A. Gray (Emory baccharis) [Compositae]

101 Baccharis glutinosa Pursh. (Seepwillow baccharis) [Compositae]

102 Baccharis pilularis DeCandolle (Kidneywort baccharis) [Compositae]

103 Baccharis sarothroides (Broom baccharis) [Compositae]

104 Baccharis sergiloides Gray (Squaw baccharis) [Compositae]

105 Baccharis viminea (Mulefat baccharis) [Compositae]

106 Bebbia spp. (Bebbia) [Compositae]

107 Bebbia juncea (Rush bebbia) [Compositae]

108 Berberis spp. (=Mahonia spp.) (Barberry) [Berberidaceae]

109 Berberis aquifolium Pursh (Shining barberry,Oregon grape) [Berberidaceae]

110 Mahonia fremontii (Torr.) Fedde (Fremont barberry) [Berberidaceae]

111 Berberis haematocarpa Watson (Red barberry) [Berberidaceae]

112 Mahonia repens (Lindl.) G. Don (Creeping barberry) [Berberidaceae]

113 Bernardia spp. (Bernardia) [Euphorbiaceae]

114 Bernardia incana Morton [Euphorbiaceae]

115 Betula spp. L. (Birch) [Betulaceae]

116 Betula glandulosa Hook. (Bog birch) [Betulaceae]

117 Betula occidentalis Hook. (Water birch) [Betulaceae]

118 Atriplex parryi S. Watson (Parry saltbush) [Chenopodiaceae]

119 Betula verrurosa [Betulaceae]

120 Brickellia spp. (Brickellia) [Compositae]

121 Brickellia amplexicanlis Robinson [Compositae]

122 Brickellia betonicaefolia Gray [Compositae]

123 Brickellia californica (T.& G.) Gray (California brickellia) [Compositae]

124 Brickellia coulteri Gray [Compositae]

125 Brickellia grandifolia (Tasselflower brickellia) [Compositae]

126 Brickellia lemmonii Gray [Compositae]

127 Brickellia microphylla Gray (Littleleaf brickellia) [Compositae]

128 Brickellia rusbyi A. Gray [Compositae]

129 Brickellia simplex Gray [Compositae]

130 Buddleia spp. (Butterflybush) [Loganiaceae]

131 Buddleia utahensis Coville (Utah butterflybush) [Loganiaceae]

132 Atriplex welshii C.A. Hanson (Welsh saltbrush) [Chenopodiaceae]

133 Atriplex pleiantha W.A. Weber [Chenopodiaceae]

134 Atriplex torreyi (Watson)Watson [Chenopodiaceae]

135 Atriplex truncata A. Gray (Wedgescale saltbrush) [Chenopodiaceae]

136 Canotia spp. (Canotia) [Canotiaceae]

137 Canotia holocantha (Mojave canotia) [Canotiaceae]

138 Carnegiea spp. (Britton & Rose) (Saguaro) [Cactaceae]

139 Carnegiea gigantea (Engelm.)Britt&Rose (Giant saguaro) [Cactaceae]

140 Caragana arborescens Lam. (Siberian peashrub) [Fabaceae]

141 Caragana arborescens pygmaea (Pygmy peashrub) [Fabaceae]

142 Cassia spp. (Senna,coffeeweed) [Leguminosae]

143 Cassia armata (Desert senna) [Leguminosae]

144 Cassia covesii Gray (Hairy senna) [Leguminosae]

145 Cassiope spp. (Cassiope) [Ericaceae]

146 Cassiope mertensiana [Ericaceae]

147 Cassiope mertensiana mertensiana (Mertens cassiope) [Ericaceae]

148 Cassiope mertensiana gracilis Piper [Ericaceae]

149 Ceanothus spp. L. (Ceanothus) [Rhamnaceae]

150 Ceanothus arboreus Greene (Feltleaf ceanothus) [Rhamnaceae]

151 Ceanothus californicus Kellogg (California ceanothus) [Rhamnaceae]

152 Ceanothus fendleri A. Gray (Fendler ceanothus) [Rhamnaceae]

153 Ceanothus greggii Gray (Mojave desert ceanothus) [Rhamnaceae]

154 Ceanothus integerrimus (Deerbrush ceanothus) [Rhamnaceae]

155 Ceanothus martinii M.E. Jones (Martin ceanothus) [Rhamnaceae]

156 Ceanothus prostratus Bentham (Squawcarpet ceanothus) [Rhamnaceae]

157 Ceanothus sanguineus (Redstem ceanothus) [Rhamnaceae]

158 Ceanothus thyrsiflorus Eschsch. (Blueblossom ceanothus) [Rhamnaceae]

159 Ceanothus velutinus Dougl. (Snowbrush ceanothus) [Rhamnaceae]

160 Celtis spp. L. (Hackberry) [Ulmaceae]

161 Celtis pallida Torr. (Spiny hackberry) [Ulmaceae]

162 Ceratoides spp. (Winterfat) [Chenopodiaceae]

163 Ceratoides lanata (Pursh.)J.T. Howell (Common winterfat) [Chenopodiaceae] Primary Use(s): Browse,forage Palatability: High

164 Cercidium spp. Tulasne (Paloverde) [Leguminosae]

165 Ayenia spp. (Ayenia) [Sterculiaceae]

166 Cercidium microphyllum (Torr.)Rose&Johnst. (Littleleaf paloverde) [Leguminosae]

167 Cercis spp. Linnaeus (Redbud) [Zygophyllaceae]

168 Cercis occidentalis Torr. ex Gray (California redbud) [Zygophyllaceae]

169 Cercocarpus spp. H.B.K. (Mountain mahogany) [Rosaceae] Primary Use(s): Browse Palatability: High

170 Cercocarpus intricatus S. Wats. (Littleleaf mountain mahogany) [Rosaceae] Primary Use(s): Browse Palatability: High

171 Cercocarpus ledifolius Nutt. (Curlleaf mountain mahogany) [Rosaceae] Primary Use(s): Browse Palatability: High

172 Cercocarpus montanus Raf. (True mountain mahogany) [Rosaceae] Primary Use(s): Browse Palatability: High

173 Chamaebatiaria spp. [Rosaceae]

174 Chamaebatiaria millefolium (Desertsweet) [Rosaceae]

175 Chilopsis spp. (Desert willow) [Bigioniaceae]

176 Chilopsis linearis (Desert willow) [Bigioniaceae]

177 Chrysothamnus albidus Greene (Alkali rabbitbrush) [Compositae] Primary Use(s): Ground Cover Palatability: None

178 Chrysothamnus depressus Nutt. (Dwarf rabbitbrush) [Compositae] Primary Use(s): Browse,revegetation Palatability: High

179 Chrysothamnus greenei Greene (Greenes rabbitbrush) [Compositae]

180 Chrysothamnus linifolius Greene (Spreading rabbitbrush) [Compositae] Primary Use(s): Soil stabilization Palatability: None

181 Chrysothamnus nauseosus (Pallas)Britt. (Rubber rabbitbrush) [Compositae] Primary Use(s): Soil stabilization Palatability: Variable

182 Chrysothamnus nauseosus albicaulis Rydb. (White rubber rabbitbrush) [Compositae]

183 Chrysothamnus nauseosus salicifolius Hall (Mountain rubber rabbitbrush) [Compositae]

184 Chrysothamnus nauseosus graveolens Hall & Clements (Green rubber rabbitbrush) [Compositae]

185 Chrysothamnus nauseosus consimilis (Threadleaf rubber rabbitbrush) [Compositae]

186 Chrysothamnus parryi (Gray)Greene (Parry rabbitbrush) [Compositae] Primary Use(s): Browse,stabilization Palatability: Low

187 Chrysothamnus parryi parryi (Parry rabbitbrush) [Compositae]

188 Chrysothamnus parryi attenuatus (M.E. Jones)Kittell [Compositae]

189 Chrysothamnus parryi howardi (Parry)Kittell (Howard rabbitbrush) [Compositae]

190 Chrysothamnus parryi nevadensis (A. Gray)Kittell (Nevada rabbitbrush) [Compositae]

191 Chrysothamnus viscidiflorus (Hooker)Nuttall (Douglas rabbitbrush) [Compositae] Primary Use(s): Browse Palatability: High

192 Chrysothamnus viscidiflorus viscidiflorus (Stickyleaf low rabbitbrush) [Compositae]

193 Chrysothamnus viscidiflorus lanceolatus (Nutt.)H.& C. (Mountain low rabbitbrush) [Compositae]

194 Chrysothamnus viscidiflorus puberulus Hall & Clements (Hairy low rabbitbrush) [Compositae]

195 Chrysothamnus viscidiflorus stenophyllus Hall & Clements (Narrowleaf low rabbitbrush) [Compositae]

196 Clematis spp. (Virginsbower) [Ranunculaceae]

197 Clematis ligusticifolia Nutt. (Western virginsbower) [Ranunculaceae]

198 Clematis ligusticifolia ligusticifolia (Western virginsbower) [Ranunculaceae]

199 Clematis psuedoalpina A. Nels. (Rocky Mountain clematis) [Ranunculaceae]

200 Coleogyne spp. (Blackbrush) [Rosaceae]

201 Coleogyne ramosissima Torr. (Blackbrush) [Rosaceae]

202 Colutea spp. (Bladdersenna) [Fabaceae]

203 Colutea arborescens L. (Common bladdersenna) [Fabaceae]

204 Colutea istria (Medditerranean bladdersenna) [Fabaceae]

205 Condalia spp. Cav. (Condalia) [Rhamnaceae]

206 Condalia lycioides Weberb. [Rhamnaceae]

207 Condalia lycioides lygcioides (Southwestern desert condalia) [Rhamnaceae]

208 Condalia lycioides canescens Trelease [Rhamnaceae]

209 Cornus spp. Linnaeus (Dogwood) [Cornaceae]

210 Cornus stolonifera Michx. (Redosier dogwood) [Cornaceae]

211 Cornus stolonifera stolonifera (Redosier dogwood) [Cornaceae]

212 Ayenia pusila Griseb. (Dwarf ayenia) [Sterculiaceae]

213 Cornus stolonifera occidentalis (Torr. & Gray)C.L. Hitchc. (Western dogwood) [Cornaceae]

214 Corylus spp. (Filbert) [Corylaceae]

215 Corylus californica Rose (California filbert) [Corylaceae]

216 Coryphantha spp. (Coryphantha) [Cactaceae]

217 Coryphantha vivipara Britton & Rose [Cactaceae]

218 Cowania spp. D. Don (Cliffrose) [Rosaceae]

219 Cowania mexicana D. Don (Mexican cliffrose) [Rosaceae]

220 Cowania mexicana stansburiana (Torr.)Jepson (Stansbury cliffrose) [Rosaceae] Primary Use(s): Browse Palatability: High

221 Coursetia spp. (Coursetia) [Leguminosae]

222 Coursetia microphylla [Leguminosae]

223 Cylindropuntia spp. (Cholla) [Cactaceae]

224 Dalea spp. Linnaeus (Dalea) [Leguminosae]

225 Dalea albiflora Gray [Leguminosae]

226 Dalea arborescens Torr. (Mojave dalea) [Leguminosae]

227 Dalea formosa Torr. (Feather dalea) [Leguminosae]

228 Dalea fremontii Torr. (Fremont dalea) [Leguminosae]

229 Dalea parryi Torr. & Gray (Parry dalea) [Leguminosae]

230 Dalea polyadenia Torr. (Nevada dalea) [Leguminosae]

231 Dryas spp. (Dryad) [Rosaceae]

232 Dryas octopetala Linnaeus [Rosaceae]

233 Dryas octopetala angustifolia C.L. Hitchcock [Rosaceae]

234 Dryas octopetala hookeriana (Juzepczuk)Hulten (Mt. Washington dryad) [Rosaceae]

235 Echinocactus spp. (Barrel cactus) [Cactaceae]

236 Echinocactus acanthodes Lem. (Barrel cactus) [Cactaceae]

237 Echinocactus polycephalus [Cactaceae]

238 Echinocactus polycephalus xeranthemoides Coult. (Cottontop echinocactus) [Cactaceae]

239 Echinocereus spp. (Hedgehog cactus) [Cactaceae]

240 Echinocereus triglochidiatus (Claret cup hedgehog) [Cactaceae]

241 Elaeagnus spp. L. (Elaeagnus) [Elaeagnaceae]

242 Elaeagnus angustifolia L. (Russian-olive) [Elaeagnaceae]

243 Ephedra spp. (Ephedra) [Ephedraceae]

244 Ephedra nevadensis (Nevada ephedra) [Ephedraceae]

245 Ephedra torreyana Wats. (Torrey ephedra) [Ephedraceae]

246 Ephedra trifurca (Longleaf ephedra) [Ephedraceae]

247 Ephedra viridis Coville (Green ephedra) [Ephedraceae]

248 Eriodictyon spp. (Yerba-santa) [Hydrophillaceae]

249 Eriodictyon angustifolium Nuttall (Narrowleaf yerba-santa) [Hydrophillaceae]

250 Eriogonum spp. (Wild buckwheat) [Polygonaceae]

251 Eriogonum corymbosum Bentham (Corymbed wildbuckwheat) [Polygonaceae]

252 Eriogonum fasciculatum Bentham (California flattop buckwheat) [Polygonaceae]

253 Eriogonum leptocladon Torr. & Gray [Polygonaceae]

254 Eriogonum microthecum (Slenderbrush eriogonum) [Polygonaceae]

255 Eriogonum umbellatum (Sulfur wild buckwheat) [Polygonaceae]

256 Eriogonum wrightii Torr. (Wright eriogonum) [Polygonaceae]

257 Eysenhardtia spp. Humboldt (Eysenhardtia) [Leguminosae]

258 Eysenhardtia polystachya (Ort.) Sarg. (Kidneywood) [Leguminosae]

259 Fallugia spp. (Apacheplume) [Rosaceae]

260 Fallugia paradoxa (Don)Endl. (Common apacheplume) [Rosaceae] Primary Use(s): Browse Palatability: Low to moderate

261 Fendlera spp. (Fendlerbush) [Philadelphaceae]

262 Fendlera rupicola (Cliff fendlerbush) [Philadelphaceae]

263 Forestiera spp. Poir. (Forestiera) [Oleaceae]

264 Forestiera neomexicana A. Gray (Desert olive) [Oleaceae]

265 Franseria spp. (=Ambrosia) (Ambrosia) [Compositae]

266 Berberis repens Lindl. (Creeping barberry) [Berberidaceae]

267 Berberis fremontii Torr. (Fremont barberry) [Berberidaceae]

268 Ribes sanguineum (California red-flowering currant) [Saxifragaceae]

269 Crataegus carrierei [Rosaceae]

270 Garrya spp. Dougl. (Silktassel) [Garryaceae]

271 Garrya wrighti (Wright silktassel) [Garryaceae]

272 Gaultheria spp. (Honeylocust) [Ericaceae]

273 Gaultheria humifusa Rydb. (Western honeylocust,W. wintergreen) [Ericaceae]

274 Betula papyrifera Marsh. (Paper birch) [Betulaceae]

275 Brickellia atractyloides Gray (Spiny brickellia) [Compositae]

276 Glossopetalon spp. (Greasebush) [Celastraceae]

277 Glossopetalon meionandra Koehne [Celastraceae]

278 Glossopetalon nevadensis (Nevada greasebush) [Celastraceae]

279 Glossopetalon spinescens Gray (Spiny greasebush) [Celastraceae]

280 Grayia spp. (Hopsage) [Chenopodiaceae]

281 Grayia brandegei A. Gray (Spineless hopsage) [Chenopodiaceae]

282 Grayia spinosa Moq. (Spiny hopsage) [Chenopodiaceae]

283 Gutierrezia spp. (Snakeweed) [Compositae]

284 Gutierrezia californica Torr. & Gray (California snakeweed) [Compositae]

285 Gutierrezia sarothrae (Pursh)Britt. & Rusby (Broom snakeweed, broomweed) [Compositae] Primary Use(s): Soil stabilization Palatability: Low or poisonous

286 Halliophytum spp. I.M. Johnston (Chuckawalabush) [Euphorbiaceae]

287 Halliophytum hallii I.M. Johnston (Halls chuckawalabush) [Euphorbiaceae]

288 Holodiscus spp. (Oceanspray) [Rosaceae]

289 Holodiscus discolor Maxim. (Rockspirea,oceanspray,hardhack) [Rosaceae]

290 Holodiscus dumosus (Nutt.)Heller (Bush ocean-spray) [Rosaceae]

291 Hymenoclea spp. (Burrobrush) [Compositae]

292 Hymenoclea monogyra (Singlewhorl burrobrush) [Compositae]

293 Hymenoclea pentalepis Rydb. [Compositae]

294 Hymenoclea salsola (White burrobrush) [Compositae]

295 [Record Deleted]

296 [Record Deleted]

297 Hyptis spp. (Bushmint) [Labiatae]

298 Hyptis emoryi Torr. (Emory bushmint) [Labiatae]

299 Indigofera spp. (Indigofera) [Leguminosae]

300 Indigofera sphaerocarpa A. Gray (Sonora indigofera) [Leguminosae]

301 Jamesia spp. (Jamesia) [Philadelphaceae]

302 Jamesia americana Torr. & Gray [Philadelphaceae]

303 Jamesia americana americana (Cliff jamesia) [Philadelphaceae]

304 Jamesia americana californica Jepson (California cliff jamesia) [Philadelphaceae]

305 Janusia spp. (Janusia) [Malphigiaceae]

306 Janusia gracilis Gray (Slender janusia) [Malphigiaceae]

307 Brickellia frutescens Gray (Rigid brickellia) [Compositae]

308 Brickellia desertorum Coville (Desert brickellia) [Compositae]

309 Juniperus spp. Linnaeus (Juniper) [Cupressaceae]

310 Juniperus communis Linnaeus (Mountain common juniper) [Cupressaceae]

311 Brickellia incana Gray (White brickellia) [Compositae]

312 Juniperus osteosperma (=J. utahensis) (Torr.)Little (Utah juniper) [Cupressaceae]

313 Brickellia longifolia Watson (Longleaf brickellia) [Compositae]

314 Kalmia spp. (Laurel) [Ericaceae]

315 Kalmia polifolia [Ericaceae]

316 Kalmia polifolia microphylla (Hooker)Cald. & Tayl. (Alpine bog kalmia) [Ericaceae]

317 Kochia spp. (Summer cypress) [Chenopodiaceae]

318 Kochia americana S. Wats. (Desert molly) [Chenopodiaceae]

319 Brickellia oblongifolia Nuttall [Compositae]

320 Brickellia multiflora Kellogg (Inyo brickellia) [Compositae]

321 Krameria spp. (Krameria) [Krameriaceae]

322 Krameria glandulosa Rose & Painter (Range krameria) [Krameriaceae]

323 Krameria grayi Rose & Painter (Grays krameria) [Krameriaceae]

324 Krameria parvifolia (Littleleaf krameria) [Krameriaceae]

325 Larrea spp. Vail (Creosotebush) [Zygophyllaceae]

326 Larrea tridentata tridentata [Zygophyllaceae]

327 Larrea tridentata Cav. (Coville creosotebush) [Zygophyllaceae]

328 Ledum spp. (Ledum) [Ericaceae]

329 Ledum glandulosum (Western ledum) [Ericaceae]

330 Buddleia davidi (Orange-eye butterflybush) [Loganiaceae]

331 Brickellia watsonii Robinson (Watson brickellia) [Compositae]

332 Lonicera spp. Linnaeus (Honeysuckle) [Caprifoliaceae]

333 Lonicera hispidula (California honeysuckle) [Caprifoliaceae]

334 Lonicera involucrata (Rich.) Banks (Bearberry,bush honeysuckle) [Caprifoliaceae]

335 Lonicera utahensis Watson (Utah honeysuckle) [Caprifoliaceae]

336 Lycium spp. (Wolfberry) [Solanaceae]

337 Lycium andersonii Gray (Anderson wolfberry) [Solanaceae]

338 Lycium berlandieri Dun. [Solanaceae]

339 Lycium exsertum Gray [Solanaceae]

340 Lycium fremontii Gray (Fremont wolfberry) [Solanaceae]

341 Lycium pallidum Miers (Pale wolfberry) [Solanaceae]

342 Lycium torreyi Gray (Torrey wolfberry) [Solanaceae]

343 Ceanothus lemmoni Parry (Lemmon ceanothus) [Rhamnaceae]

344 Buddleia hartwegi [Loganiaceae]

345 Ceanothus cordulatus Kellogg (Mountain whitethorn ceanothus) [Rhamnaceae]

346 Ceanothus cuneatus (Wedgeleaf ceanothus,buckbrush) [Rhamnaceae]
Primary Use(s): Browse Palatability: High

347 Mahonia spp. (=Berberis spp.) (barberry) [Berberidaceae]

348 Menodora spp. (Menodora) [Oleaceae]

349 Menodora spinsescens (Spiny menodora) [Oleaceae]

350 Menziesia spp. J.E. Smith (Menziesia) [Ericaceae]

351 Menziesia ferruginea (Rusty menziesia) [Ericaceae]

352 Celtis reticulata Torr. (Netleaf hackberry) [Ulmaceae]

353 Ceanothus lorenzenii (Jepson)McMinn. [Rhamnaceae]

354 Celtis douglasii (Douglas hackberry) [Ulmaceae]

355 Celtis occidentalis (Common hackberry) [Ulmaceae]

356 Cercocarpus betuloides Nuttall (Birchleaf mountain mahogany) [Rosaceae]

357 Atriplex semibaccata R. Br. (Australian saltbrush) [Chenopodiaceae]

358 Neollydia spp. (Button cactus) [Cactaceae]

359 Neollydia johnsonii [Cactaceae]

360 Opuntia spp. (Pricklypear) [Cactaceae]

361 Opuntia acanthocarpa Engelmann & Bigelow (Buckhorn cholla) [Cactaceae]

362 Opuntia basilaris Engelmann (Beavertail pricklypear) [Cactaceae]

363 Opuntia echinocarpa Engelmann & Bigelow (Strawtop pricklypear) [Cactaceae]

364 Opuntia ficus indicus (L.)Miller (Indianfig) [Cactaceae]

365 Opuntia fragilis (Brittle pricklypear) [Cactaceae]

366 Opuntia inermis DeCandolle [Cactaceae]

367 Opuntia phaeacantha Engelmann (Purple-fruited pricklypear) [Cactaceae]

368 Opuntia polyacantha Haworth (Plains pricklypear) [Cactaceae]

369 Opuntia pulchella Engelmann [Cactaceae]

370 Opuntia tuna (Tuna opuntia) [Cactaceae]

371 Pachistima spp. (Pachistima) [Celastraceae]

372 Pachistima myrsinites (Myrtle pachistima) [Celastraceae]

373 Pediocactus spp. (Pediocactus) [Cactaceae]

374 Pediocactus simpsonii Britton & Rose (Plains cactus) [Cactaceae]

375 Peraphyllum spp. (Peraphyllum) [Rosaceae]

376 Peraphyllum ramosissimum Nutt. (Squaw-apple) [Rosaceae] Primary Use(s): Browse,edible fruits Palatability: Moderate

377 Peucephyllum spp. (Sprucebush) [Compositae]

378 Peucephyllum schottii (Schotts sprucebush) [Compositae]

379 Chrysothamnus humilis Greene (Depauperate rabbitbrush) [Compositae]

380 Philadelphus spp. Linnaeus (Mockorange) [Philadelphaceae]

381 Philadelphus argyrocalyx Wooton [Philadelphaceae]

382 Philadelphus microphyllus Gray (Littleleaf mockorange) [Philadelphaceae]

383 Phyllodoce spp. (Mountainheath) [Ericaceae]

384 Phyllodoce empetriformis (Red mountainheath) [Ericaceae]

385 Phyllodoce glanduliflora (Hooker)Coville (Cream mountainheath) [Ericaceae]

386 Physocarpus spp. Maxim. (Ninebark) [Rosaceae]

387 Physocarpus malvaceus (Greene)Kuntze (Mallow ninebark) [Rosaceae]

388 Chrysothamnus viscidiflorus latifolius (D.C. Eat.)Rydb. [Compositae]

389 Chrysothamnus nauseosus nauseosus Hall & Clements (Rubber rabbitbrush) [Compositae]

390 Ceanothus sorediatus (Mountain lilac) [Rhamnaceae]

391 Platyopuntia spp. (Platyopuntia) [Cactaceae]

392 Pluchea spp. (Pluchea) [Compositae]

393 Pluchea sericea Coville (Marsh fleabane) [Compositae]

394 Poliomintha spp. (Rosemarymint) [Labiatae]

395 Poliomintha incana (Hoary rosemarymint) [Labiatae]

396 Polygala spp. (Polygala) [Polygalaceae]

397 Polygala acanthoclada (Thorn polygala) [Polygalaceae]

398 Polygala subspinosa (Spiny polygala) [Polygalaceae]

399 Clematis brevicaudata (Shortplume clematis) [Ranunculaceae]

400 Chrysothamnus pulchellus Greene (Southwest rabbitbrush) [Compositae]

401 Chrysothamnus teretifolius Hall (Roundleaf rabbitbrush) [Compositae]

402 Chrysothamnus vaseyi (Gray)Greene (Vasey rabbitbrush) [Compositae] Primary Use(s): Browse Palatability: Low

403 Clematis aurea [Ranunculaceae]

404 Potentilla spp. (Cinquefoil) [Rosaceae]

405 Potentilla fruticosa L. (Bush cinquefoil) [Rosaceae]

406 Prosopis spp. (Mesquite) [Leguminosae]

407 Prosopis glandulosa Torr. (Honey mesquite) [Leguminosae]

408 Prosopis juliflora (Swartz)DeCandolle (Mesquite) [Leguminosae] Primary Use(s): Forage Palatability: High

409 Prosopis pubescens (Screwbean mesquite) [Leguminosae]

410 Prosopis velutina Wooton (Velvet mesquite) [Leguminosae]

411 Prunus spp. (Cherry) [Rosaceae]

412 Prunus fesciculata (Desert peach) [Rosaceae]

413 Prunus emarginata (Douglas)Walpers (Bitter cherry) [Rosaceae]

414 Prunus vireus [Rosaceae]

415 Prunus virginiana Linnaeus (Western common chokecherry) [Rosaceae]

416 Clematis missouriensis Rydb. [Ranunculaceae]

417 Clematis columbiana Torr. & Gray (Columbian clematis) [Ranunculaceae]

418 Clematis hirsutissima Pursh [Ranunculaceae]

419 Cotoneaster integerrima (European cotoneaster) [Rosaceae]

420 Cotoneaster acutifolia (Peking cotoneaster) [Rosaceae]

421 Ptelea spp. Linnaeus (Hoptree,shrubby trefoil) [Rutaceae]

422 Ptelea baldwinii (Baldwin hoptree) [Rutaceae]

423 Ptelea pallida Greene (Pale hoptree) [Rutaceae]

424 Ptelea trifoliata Linnaeus (Common hoptree) [Rutaceae]

425 Purshia spp. (Bitterbrush) [Rosaceae]

426 Purshia glandulosa Curran (Desert bitterbrush) [Rosaceae] Primary Use(s): Browse Palatability: Moderate to high

427 Purshia tridentata (Pursh)DeCandolle (Antelope bitterbrush) [Rosaceae] Primary Use(s): Browse Palatability: High

428 Quercus spp. (Oak) [Fagaceae] Primary Use(s): Browse,edible fruits Palatability: High

429 Quercus arizonica Sarg. (Arizona white oak) [Fagaceae]

430 Quercus dumosa Nuttall (California shrub oak, C. scrub oak) [Fagaceae]

431 Quercus emoryi Torr. (Emory oak) [Fagaceae]

432 Quercus gambelii Nutt. (Gambel oak) [Fagaceae]

433 Quercus grisea Liebm. (Gray oak) [Fagaceae]

434 Quercus havardi Rydb. (Havard oak) [Fagaceae]

435 Quercus hypoleneoides [Fagaceae]

436 Cotoneaster racemiflora (Redbead cotoneaster) [Rosaceae]

437 Cotoneaster tomentosa (Brickberry cotoneaster) [Rosaceae]

438 Quercus reticulata (Netleaf oak) [Fagaceae]

439 Quercus turbinella Greene (Shrub live oak) [Fagaceae]

440 Quercus undulata (Wavyleaf oak) [Fagaceae]

441 Rhamnus spp. (Buckthorn) [Rhamnaceae]

442 Rhamnus alnifolia L'Her. (Alder buckthorn) [Rhamnaceae]

443 Rhamnus californica Eschsch. (California buckthorn,C. coffeeberry) [Rhamnaceae]

444 Rhamnus purshiana DC. (Cascara buckthorn) [Rhamnaceae]

445 Rhamnus smithii Greene (Buckthorn) [Rhamnaceae]

446 Rhus spp. Linnaeus (Sumac) [Anacardiaceae]

447 Rhus allegheniensis [Anacardiaceae]

448 Rhus aromatica (Fragrant sumac) [Anacardiaceae]

449 Rhus copallina Linnaeus (Flameleaf sumac) [Anacardiaceae]

450 Rhus emoryi Wooton (Emory sumac) [Anacardiaceae]

451 Rhus glabra Linnaeus (Smooth sumac) [Anacardiaceae]

452 Rhus haurina [Anacardiaceae]

453 Rhus ovata Wats. (Sugar sumac,sugarbush) [Anacardiaceae]

454 Rhus simplicifolia [Anacardiaceae]

455 Rhus trilobata Nutt. (Skunkbush sumac,squawbush sumac) [Anacardiaceae]

456 Rhus typhina Linnaeus (Staghorn sumac) [Anacardiaceae]

457 Ribes spp. Linnaeus (Currant,gooseberry) [Saxifragaceae]

458 Ribes aureum Pursh (Golden currant) [Saxifragaceae]

459 Ribes bracteosum (Stink currant) [Saxifragaceae]

460 Ribes cereum Dougl. (Wax currant) [Saxifragaceae]

461 Ribes glandulosum (Skunk currant) [Saxifragaceae]

462 Ribes inebrians Lindl. (Squaw currant) [Saxifragaceae]

463 Ribes inerme Rydb. (Whitestem gooseberry) [Saxifragaceae]

464 Ribes lacustre (Pers.)Poir (Prickly currant) [Saxifragaceae]

465 Ribes leptanthum Gray (Trumpet gooseberry) [Saxifragaceae]

466 Ribes montigenum McClatchie (Gooseberry currant) [Saxifragaceae]

467 Caragana spp. Lam. (Pea tree) [Fabaceae]

468 Ribes petiolare Douglas (Western black currant) [Saxifragaceae]

469 Ribes pinetorum Greene (Orange gooseberry) [Saxifragaceae]

470 Ribes roezli Greene (Sierra gooseberry) [Saxifragaceae]

471 Ribes viscossissimum Pursh (Sticky currant) [Saxifragaceae]

472 Ribes wolfii (Rothrock currant) [Saxifragaceae]

473 Crataegus douglasii Lindl. (Douglas hawthorn) [Rosaceae]

474 Cotoneaster turkestanica [Rosaceae]

475 Rosa spp. (Rose) [Rosaceae]

476 Rosa arizonica Rydb. [Rosaceae]

477 Rosa fendleri Crepin. [Rosaceae]

478 Rosa nutkana Presl. (Nootka rose) [Rosaceae]

479 Rosa acicularis Lindl. (Prickly rose) [Rosaceae]

480 Rosa woodsii Lindl. (Woods rose) [Rosaceae] Primary Use(s): Browse,edible fruits Palatability: Moderate to high

481 Rubus spp. (Raspberry,dewberry,bramble) [Rosaceae]

482 Rubus arizonensis Focke. [Rosaceae]

483 Rubus circinus [Rosaceae]

484 Rubus idaeus Linnaeus (Red raspberry) [Rosaceae]

485 Rubus neomexicanus Gray (New Mexican raspberry) [Rosaceae]

486 Rubus parviflorus Nuttall (Thimbleberry) [Rosaceae]

487 Rubus strigosis Michx. (American red raspberry) [Rosaceae]

488 Rubus vitifolius C. & S. (Logan blackberry) [Rosaceae]

489 Salazeria spp. (Bladdersage) [Labiatae]

490 Salazeria mexicana (Mexican bladdersage) [Labiatae]

491 Salix spp. (Willow) [Salicaceae]

492 Salix alaxensis Coville (Feltleaf willow) [Salicaceae]

493 Salix bebbiana Sarg. (Smooth bebb willow) [Salicaceae]

494 Dalea kingii Watson (King dalea) [Leguminosae]

495 Salix coulteri Anderss. (Coulter willow) [Salicaceae]

496 Salix exigua Nutt. (Dusky or coyote willow) [Salicaceae]

497 Dalea mollissima (Rydb.)Munz [Leguminosae]

498 Salix nivalis Hooker (Snow willow) [Salicaceae]

499 Salix reticulata (Netleaf willow) [Salicaceae]

500 Dalea terminalis M.E. Jones [Leguminosae]

501 Salvia spp. (Sage) [Labiatae]

502 Salvia amissa Epling. [Labiatae]

503 Salvia apiana Jepson (White sage) [Labiatae]

504 Salvia pinguifolia Wooton & Standley [Labiatae]

505 Sambucus spp. (Elder) [Caprifoliaceae]

506 Sambucus canadensis Linnaeus (American elder) [Caprifoliaceae]

507 Sambucus cerulea (=S. glauca) Raf. (Blueberry elder) [Caprifoliaceae]

508 Sambucus melanocarpa A. Gray (Blackhead elder) [Caprifoliaceae]

509 Sambucus mexicana Presl. ex DeCandolle Sarg. (Mexican elder) [Caprifoliaceae]

510 Sambucus microbotrys Rydb. (Bunchberry elder) [Caprifoliaceae]

511 Sambucus pubens Michx. (Scarlet elder) [Caprifoliaceae]

512 Sclerocactus spp. Britton & Rose (Barrel cactus) [Cactaceae]

513 Sclerocactus mesae-verdae [Cactaceae]

514 Sclerocactus polyancistrus Britton & Rose (Pineapple barrel) [Cactaceae]

515 Sclerocactus whipplei Britton & Rose (Devil's claw barrel) [Cactaceae]

516 Echinocereus fendleri (Fendler echinocereus) [Cactaceae]

517 Dalea thompsonae L.O. Williams (Thompson dalea) [Leguminosae]

518 Shepherdia spp. Nuttall (Buffaloberry) [Elaeagnaceae]

519 Shepherdia argentea (Pursh) Nutt. (Silver buffaloberry) [Elaeagnaceae]

520 Shepherdia canadensis (L.) Nutt. (Russet buffaloberry) [Elaeagnaceae]

521 Shepherdia rotundifolia (Roundleaf buffaloberry) [Elaeagnaceae]

522 Simmondsia spp. (Jojoba) [Simmondsiaceae]

523 Simmondsia californica (California jojoba) [Simmondsiaceae]

524 Sophora spp. L. (Sophora) [Fabaceae]

525 Sophora secundiflora (Ortega)Lag. (Mescalbean sophora) [Fabaceae]

526 Spiraea spp. (Spirea) [Rosaceae]

527 Spiraea betulifolia (Birchleaf spirea) [Rosaceae]

528 Spiraea lucida Doulgas ex Greene (Shinyleaf spirea) [Rosaceae]

529 Ephedra aspersa Engelmann ex S. Watson (Rough ephedra) [Ephedraceae]

530 Encelia frutescens (Bush encelia) [Compositae]

531 Ephedra fasciculata A. Nels. [Ephedraceae]

532 Ephedra cutleri Peebles (Cutler ephedra) [Ephedraceae]

533 Eriogonum divergens Small [Polygonaceae]

534 Symphoricarpos spp. (Dill.)Ludwig (Snowberry,Indian currant,coralberry) [Caprifoliaceae]

535 Symphoricarpos albus (Linnaeus) Blake (Common snowberry) [Caprifoliaceae]

536 Symphoricarpos hesperius G.N. Jones (Creeping snowberry) [Caprifoliaceae]

537 Symphoricarpos longiflorus Gray (Longflower snowberry) [Caprifoliaceae]

538 Symphoricarpos occidentalis Hook. (Western snowberry,wolfberry) [Caprifoliaceae]

539 Symphoricarpos oreophilus Gray (Mountain snowberry) [Caprifoliaceae]

540 Symphoricarpos racemosus (=S. rotundifolius) [Caprifoliaceae]

541 Symphoricarpos rotundifolius (=S. racemosus) (Roundleaf snowberry) [Caprifoliaceae]

542 Symphoricarpos utahensis Rydb. (Utah snowberry) [Caprifoliaceae]

543 Symphoricarpos vaccinioides Rydb. (Whortleleaf snowberry) [Caprifoliaceae]

544 Syringa spp. (Lilac) [Oleaceae]

545 Syringa henryi (Henry lilac) [Oleaceae]

546 Syringa villosa (Late lilac) [Oleaceae]

547 Syringa vulgaris Linnaeus (Common lilac) [Oleaceae]

548 Tetradymia spp. (Horsebrush) [Compositae]

549 Tetradymia axillaris Nelson (Longspine horsebrush) [Compositae]

550 Tetradymia glabrata Torr. & Gray (Littleleaf horsebrush) [Compositae]
Primary Use(s): Browse Palatability: Low or poisonous

551 Tetradymia spinosa Hook. & Arn. (Cottonthorn horsebrush) [Compositae]
Primary Use(s): Soil stabilization
Palatability: None

552 Thamnosma spp. (Desertrue) [Rutaceae]

553 Thamnosma montana Torr. & Frem. (Mojave desertrue) [Rutaceae]

554 Toxicodendron spp. (=Rhus spp.) (Poison ivy,poison oak) [Anacardiaceae]

555 Rhus radicans Linnaeus (Poison ivy) [Anacardiaceae]

556 Eriogonum heracleoides (Wyeth eriogonum) [Polygonaceae]

557 Eriogonum fruticulosum A. Nelson [Polygonaceae]

558 Vaccinium spp. (Whortleberry,blueberry,huckleberry) [Ericaceae]

559 Vaccinium mebranaceum (Big whortleberry) [Ericaceae]

560 Vaccinium myrtillus (Myrtle whortleberry) [Ericaceae]

561 Vaccinium ovatum (Box blueberry) [Ericaceae]

562 Vaccinium parvifolium (Red whortleberry) [Ericaceae]

563 Vaccinium scoparium Lieberg ex Coville (Grouse whortleberry) [Ericaceae]

564 Eriogonum ovalifolium (Cushion eriogonum) [Polygonaceae]

565 Fendlerella spp. (Fendlerella) [Philadelphaceae]

566 Vauquelinia spp. Correa(Humb. & Bonpl.) (Vaquelinia) [Rosaceae]

567 Vauquelinia californica Sarg. (Torrey vauquelinia) [Rosaceae]

568 Ferocactus acanthodes lecontei (Engelmann)Lindsay [Cactaceae]

569 Fendlerella utahensis Heller (Utah fendlerella) [Philadelphaceae]

570 Viburnum spp. (Viburnum,Cranberry,Arrow-wood) [Caprifoliaceae]

571 Viburnum edule [Caprifoliaceae]

572 Viburnum lentago L. (Nannyberry virburnum) [Caprifoliaceae]

573 Xanthocephalum spp. (=Gutierrezia spp.) (Snakeweed) [Compositae]

574 Xanthocephalum lucida Greene (Sticky snakeweed) [Compositae]

575 Xanthocephalum microcephalum (D.C.)Shinners (Threadleaf snakeweed) [Compositae]

576 Xanthocephalum sarothrae (Pursh.)Shinners (Broom snakeweed) [Compositae]

577 Yucca spp. Linnaeus (Yucca) [Agavaceae]

578 Yucca angustissima Engelmann (Fineleaf yucca) [Agavaceae]

579 Yucca arborescens Engelm. ex Trelease [Agavaceae]

580 Yucca baccata Torr. (Datil yucca,spanish bayonet) [Agavaceae]

581 Yucca brevifolia Engelmann (Joshua-tree) [Agavaceae]

582 Yucca elata Engelm. (Soaptree yucca) [Agavaceae]

583 Yucca glauca (=Y. kanabensis) (Nutt.) Coville Sims. (Small soapweed,great plains yucca) [Agavaceae]

584 Yucca harrimaniae Trelease (Harriman yucca) [Agavaceae]

585 Yucca schottii Engelmann (Schotts yucca) [Agavaceae]

586 Sarcobatus vermiculatus (Hook.)Torr. (Black greasewood) [Chenopodiaceae]

587 Kochia prostrata [Chenopodiaceae]

588 Ferocactus spp. (Ferocactus) [Cactaceae]

589 Crataegus chrysocarpa Ashe (Fireberry hawthorn) [Rosaceae]

590 Atriplex rosea [Chenopodiaceae]

591 Atriplex argentia [Chenopodiaceae]

592 Chrysothamnus spp. [Compositae]

593 Artemisia vulgaris L. (Mugwort wormwood) [Compositae]

594 Sarcobatus spp. (Greasewood) [Chenopodiaceae]

595 Amorpha nana Nutt. (dwarfindigo amorpha) [Fabaceae]

596 Atriplex nuttallii S. Wats. (Nuttall saltbush) [Chenopodiaceae]

597 Berberis vulgaris L. (Common barberry) [Berberidaceae]

598 Baccharis wrightii (Wright baccharis) [Compositae]

599 Elaeagnus commutata Bernh. (Silverberry) [Elaeagnaceae]

600 Leptodactylon pungens (Torr.)Rydb. (Prickly phlox) [Polemoniaceae]

601 Lycium halimifolium Mill. (Matrimony vine) [Solanaceae]

602 Menodora scabra A. Gray (Rough menodora) [Oleaceae]

603 Physocarpus alternans (Jones)J.T. Howell (Dwarf ninebark) [Rosaceae]

604 Physocarpus opulifolius (L.)Maxim (Common ninebark) [Rosaceae]

605 Prunus americana Marsh (American plum) [Rosaceae]

606 Prunus besseyi Bailey (Bessey cherry) [Rosaceae]

607 Prunus pennsylvanica (Pincherry) [Rosaceae]

608 Rhamnus cathartica Linnaeus (Common buckthorn) [Rhamnaceae]

609 Ribes americanum Mill. (American black currant) [Saxifragaceae]

610 Rosa arkansana Porter (Arkansas rose) [Rosaceae]

611 Rubus occidentalis L. (Blackcap raspberry) [Rosaceae]

612 Salix interior Rowlee (Sandbar willow) [Salicaceae]

613 Salix petiolaris J.E. Sm. (Meadow willow) [Salicaceae]

614 Sambucus racemosa Linnaeus (Scarlet elder) [Caprifoliaceae]

615 Spiraea caespitosa Nutt. (Dwarf spiraea) [Rosaceae]

616 Symphoricarpos orbiculatus Hook. (Western snowberry) [Caprifoliaceae]

617 Tetradymia canescens DeCandolle (Gray horsebrush) [Compositae] Primary Use(s): Browse,revegetation Palatability: Low or poisonous

618 Vaccinium caespitosum Michx. (Dwarf blueberry) [Ericaceae]

619 Gutierrezia longifolia Greene [Compositae]

620 Salix regalis [Salicaceae]

621 Salix ellegantissima [Salicaceae]

622 Salix lutea Nuttall [Salicaceae]

623 Crataegus rivularis (River hawthorn) [Rosaceae]

624 Salix fluviatilis [Salicaceae]

625 Prunus melanocarpa Rydb. [Rosaceae]

626 Clematis caripensis [Ranunculaceae]

627 Viburnum opulus [Caprifoliaceae]

628 Artemisia spinosa [Compositae]

629 Agave deserti (Desert agave) [Amaryllidaceae]

630 Artemisia campestris borealis (Pallas) (Sagewort wormwood) [Compositae]

631 Acamptopappus shockleyi A. Gray [Compositae]

632 Amelanchier pumila Nuttall [Rosaceae]

633 Artemisia parryi Gray [Compositae]

634 Crataegus spp. L. [Rosaceae]

635 Eriogonum effusum Nuttall (Spreading wild buckwheat) [Polygonaceae]

636 Cotoneaster lucida (Hedge cotoneaster) [Rosaceae]

637 Echinocereus engelmanii (Parry ex Engelmann)Rumpler (Engelmann echinocereus) [Cactaceae]

638 Kochia scoparia (L.)Schrad. [Chenopodiaceae]

639 Sophora sericea (Pursh)Rydberg [Fabaceae]

640 Encelia farinosa (Incienso (White brittlebrush)) [Compositae]

641 Encelia spp. (Encelia) [Compositae]

642 Echinocereus viridiflorus Engelmann [Cactaceae]

643 Clematis orientalis Linnaeus (Oriental clematis) [Ranunculaceae]

644 Cornus nuttallii Audubon [Cornaceae]

645 Gaultheria shallon Pursh [Ericaceae]

646 Forestiera phillyreoides (New Mexican olive forestiera) [Oleaceae]

647 Garrya flavescens [Garryaceae]

648 Gaultheria ovatifolia (Slender wintergreen) [Ericaceae]

649 Glossopetalon nevadense Gray [Celastraceae]

650 Glossopetalon pungens Brand. (Dwarf greasebush) [Celastraceae]

651 Haplopappus spp.(=Aplopappus,=Icosoma) (Goldenweed) [Compositae]

652 Haplopappus bloomeri Gray (Rabbitbrush goldenweed) [Compositae]

653 Haplopappus brickelliodes Blake (Brickell goldenweed) [Compositae]

654 Haplopappus cervinus S. Watson [Compositae]

655 Haplopappus cuneatus Gray (Wedgeleaf goldenweed) [Compositae]

656 Haplopappus linearifolius DeCandolle (Narrowleaf goldenweed) [Compositae]

657 Haplopappus macronema Gray (Whitestem goldenweed) [Compositae]

658 Haplopappus nanus Eaton (Dwarf goldenweed) [Compositae]

659 Haplopappus racemosus [Compositae]

660 Haplopappus rydbergii Blake (Rydberg goldenweed) [Compositae]

661 Haplopappus scopulorum Blake [Compositae]

662 Haplopappus suffruticosus Clements & Clements (Singlehead goldenweed) [Compositae]

663 Haplopappus watsonii Gray (Watson goldenweed) [Compositae]

664 Holodiscus boursieri Rehd. [Rosaceae]

665 Houstonia spp. (Bluets) [Rubiaceae]

666 Houstonia rubra [Rubiaceae]

667 Juniperus horizontalis Moench. (Creeping juniper) [Cupressaceae]

668 Juniperus monosperma Sarg. (One-seed juniper) [Cupressaceae]

669 Laphamia spp. [Compositae]

670 Laphamia congesta M.E. Jones [Compositae]

671 Laphamia fastigiata Brandeg. [Compositae]

672 Laphamia gracilis M.E. Jones [Compositae]

673 Laphamia intricata Brandeg. [Compositae]

674 Laphamia palmeri palmeri [Compositae]

675 Laphamia stansburii Gray [Compositae]

676 Lippia spp. (Houston)L. (Lippia or fog-fruit) [Verbenaceae]

677 Lippia wrightii Gray (Wright lippia) [Verbenaceae]

678 Lonicera arizonica Rehd. (Arizona honeysuckle) [Caprifoliaceae]

679 Lonicera caerulea (Sweetberry honeysuckle) [Caprifoliaceae]

680 Lonicera ciliosa (Western trumpet honeysuckle) [Caprifoliaceae]

681 Lonicera conjugialis Kellogg (Purpleflower honeysuckle) [Caprifoliaceae]

682 Lonicera prolifera Rehd. (Grape honeysuckle) [Caprifoliaceae]

683 Lonicera tatarica Linnaeus (Tatarian honeysuckle) [Caprifoliaceae]

684 Lupinus spp. (Lupine) [Fabaceae]
Palatability: Poisonous

685 Lupinus breweri (Brewers lupine) [Fabaceae]

686 Lupinus excubitus Jones (Inyo lupine) [Fabaceae]

687 Lycium barbarum (Matrimony vine) [Solanaceae]

688 Lycium cooperi Gray (Cooper wolfberry) [Solanaceae]

689 Maclura spp. (Osage-orange) [Moraceae]

690 Maclura pomifera Schneider (Osage-orange) [Moraceae]

691 Opuntia barkleyana (Daston)Rowley [Cactaceae]

692 Opuntia bigelovii Engelmann (Arizona jumping pricklypear) [Cactaceae]

693 Opuntia chlorotica (Dollarjoint pricklypear) [Cactaceae]

694 Opuntia erinacea (Grizzlybear pricklypear) [Cactaceae]

695 Opuntia gracilicylindrica (Wieg. & Backebeg.)Rowley [Cactaceae]

696 Opuntia hystricina Engelmann & Bigelow [Cactaceae]

697 Opuntia laevis Coult. (Smooth pricklypear) [Cactaceae]

698 Opuntia parishii Orcutt (Parish cholla) [Cactaceae]

699 Opuntia pygmaea (Wieg. & Backebeg.)Rowley [Cactaceae]

700 Opuntia ramossissima Engelmann (Holycross cholla) [Cactaceae]

701 Opuntia rhodantha K. Sch. [Cactaceae]

702 Opuntia rubrifolia Griffiths Davidson [Cactaceae]

703 Opuntia spectatissima [Cactaceae]

704 Opuntia whipplei Engelmann & Bigelow (Whipple cholla) [Cactaceae]

705 Opuntia wiegandii (Backebeg.)Rowley [Cactaceae]

706 Opuntia woodsii Backebeg. [Cactaceae]

707 Ostrya spp. (Hophornbeam) [Carpinaceae]

708 Ostrya knowltoni Coville (Knowlton hophornbeam) [Carpinaceae]

709 Parryella spp. [Leguminosae]

710 Parryella filifolia (Dunebroom) [Leguminosae]

711 Parryella rotundata Wooton [Leguminosae]

712 Parthenium spp. (Parthenium) [Compositae]

713 Parthenium incanum (Mariola parthenium) [Compositae]

714 Parthenocissus spp. (Creeper) [Vitidaceae]

715 Parthenocissus inserta (Kerner)Fritsch. (Thicket creeper) [Vitidaceae]

716 Pediocactus sileri (Engelm. ex Coult.)L.Benson [Cactaceae]

717 Pediocactus paradinei B.W. Benson [Cactaceae]

718 Philadelphus lewisii (Lewis mockorange) [Philadelphaceae]

719 Prunus andersonii Gray (Anderson peachbrush) [Rosaceae]

720 Prunus demissa Nuttall (Chokecherry) [Rosaceae]

721 Prunus fruticosa [Rosaceae]

722 Prunus ilicifolia Nuttall (Hollyleaf,Catalina cherry) [Rosaceae]

723 Prunus japonica (Chinese bushcherry) [Rosaceae]

724 Prunus tenella [Rosaceae]

725 Prunus siberica (Sloe cherry) [Rosaceae]

726 Prunus spinosa (Klamath plum) [Rosaceae]

727 Prunus subcordata [Rosaceae]

728 Quercus chrysolepsis Liebmann (Palmer oak,canyon live oak) [Fagaceae]

729 Rhamnus betulaefolia obovata Kearney & Peebles (Birchleaf buckthorn) [Rhamnaceae]

730 Rhamnus davurica (Dahurian buckthorn) [Rhamnaceae]

731 Rhamnus erythroxylon [Rhamnaceae]

732 Rhamnus libanotica (Lebanon buckthorn) [Rhamnaceae]

733 Rhamnus oleoides [Rhamnaceae]

734 Rhus petiolaris (Petioled buckthorn) [Anacardiaceae]

735 Rhus rubra [Anacardiaceae]

736 Rhamnus saxatalis (Rock buckthorn) [Rhamnaceae]

737 Rhamnus spathulaefolia [Rhamnaceae]

738 Rhamnus tinctoria (Dyers buckthorn) [Rhamnaceae]

739 Rhus glabra cismontana (Greene)Rehder (Rocky Mountain smooth sumac) [Anacardiaceae]

740 Rhus microphylla Engl. (Littleleaf sumac) [Anacardiaceae]

741 Ribes coloradense Coville (Colorado currant) [Saxifragaceae]

742 Ribes hendersonii C.L. Hitchcock (Henderson gooseberry) [Saxifragaceae]

743 Ribes nevadense (Sierra currant) [Saxifragaceae]

744 Ribes niveum (Snow gooseberry) [Saxifragaceae]

745 Ribes setosum Lindl. (Missouri gooseberry) [Saxifragaceae]

746 Rhus velutinum [Anacardiaceae]

747 Rosa collaris Rydb. [Rosaceae]

748 Rosa eglanteria (Sweetbrier rose) [Rosaceae]

749 Rosa gymnocarpa (Balhip rose) [Rosaceae]

750 Rosa laxton [Rosaceae]

751 Rosa manca Greene (Mancos rose) [Rosaceae]

752 Rosa multiflora (Japanese rose) [Rosaceae]

753 Rosa stellata Wooton (Desert rose) [Rosaceae]

754 Rubus discolor (Himalayan blackberry) [Rosaceae]

755 Rubus laciniatus neomexicanus (New Mexican raspberry) [Rosaceae]

756 Salix barclayi padophylla (Rydb.)L. Kelso (Barclay willow) [Salicaceae]

757 Salix brachycarpa (Barrenground willow) [Salicaceae]

758 Salix cascadensis Cockerell (Cascades willow) [Salicaceae]

759 Salix commutata Bebb (Undergreen willow) [Salicaceae]

760 Salix drummondiana (Drummond willow) [Salicaceae]

761 Salix geyeriana (Geyer willow) [Salicaceae]

762 Salix glauca (Grayleaf willow) [Salicaceae]

763 Salix jepsonii Schn. (Jepson willow) [Salicaceae]

764 Salix laevigata (Polished willow,smooth-leaf willow) [Salicaceae]

765 Salix lasiandra Bentham (Pacific willow) [Salicaceae]

766 Salix caudata Heller (Whiplash willow) [Salicaceae]

767 Salix lasiolepis (Arroyo willow) [Salicaceae]

768 Salix lemmonii (Lemmons willow) [Salicaceae]

769 Salix monticola Bebb ex Coult. [Salicaceae]

770 Salix myrtillifolia (Blueberry willow) [Salicaceae]

771 Salix orestera Schn. (Sierra willow) [Salicaceae]

772 Salix phylicifolia [Salicaceae]

773 Salix purpurea (Purplecosier willow) [Salicaceae]

774 Salix rigida Muhl. (Mackenzie willow) [Salicaceae]

775 Salix tweedyi Ball (Tweedy's willow) [Salicaceae]

776 Salix wolfii Bebb [Salicaceae]

777 Salvia dorrii (Kell.)Abrams [Labiatae]

778 Simmondsia chinensis (Link)Schneider (Goatnut jojoba) [Simmondsiaceae]

779 Sophora arizonica (Arizona sophora) [Fabaceae]

780 Spiraea canescens (Hoary spirea) [Rosaceae]

781 Spiraea densiflora (Subalpine spirea) [Rosaceae]

782 Spiraea douglasii roseata (Rydb.)C.L. Hitchcock (Douglas spirea) [Rosaceae]

783 Spiraea pyramidata Greene (Pyramid spirea) [Rosaceae]

784 Spiraea sargentiana (Sargent spirea) [Rosaceae]

785 Symphoricarpos mollis Nuttall [Caprifoliaceae]

786 Symphoricarpos parishii Rydb. (Roundleaf snowberry) [Caprifoliaceae]

787 Tamarix spp. Linnaeus (Tamarisk) [Tamaricaceae]

788 Tamarix parvifolio (Fivestamen tamarisk) [Tamaricaceae]

789 Tamarix pentandra (Fivestamen tamarisk) [Tamaricaceae]

790 Tamarix ramosissima [Tamaricaceae]

791 Tamarix tetrandra (Fourstamen tamarisk) [Tamaricaceae]

792 Tetradymia comosa (Hairy horsebrush) [Compositae]

793 Vaccinium gobulare Rydb. (Globe huckleberry) [Ericaceae]

794 Vaccinium occidentale A. Gray (Westernbog blueberry) [Ericaceae]

795 Vaccinium ovalifolium (Ovalleaf huckleberry) [Ericaceae]

796 Vaccinium oxycoccos (Wild cranberry) [Ericaceae]

797 Vitis spp. (Grape) [Vitaceae]

798 Vitis arizonica (Canyon grape) [Vitaceae]

799 Yucca baileyi Wooton & Standley (Bailey yucca) [Agavaceae]

800 Yucca kanabensis (=Y. glauca) McKelvey [Agavaceae]

801 Yucca neomexicana Wooton & Standley (Spanish bayonet) [Agavaceae]

802 Yucca schidigera (Mohave yucca) [Agavaceae]

803 Yucca toftiae [Agavaceae]

804 Yucca utahensis McKelvey [Agavaceae]

805 Zelkova spp. (Zelkova) [Ulmaceae]

806 Zelkova serrata (Japanese zelkova) [Ulmaceae]

807 Tamarix gallica [Tamaricaceae]

808 Opuntia engelmanni Salm & Dyck [Cactaceae]

809 Umbellularia californica (Hook. & Arn.)Nutt. (California laurel) [Lauraceae]

810 Prosopis glandulosa glandulosa [Leguminosae]

811 Opuntia humifusa [Cactaceae]

812 Haplopappus venetus Blake [Compositae]

813 Larrea divaricata Cav. (Spreading creosotebush) [Zygophyllaceae] Primary Use(s): Small-mammal food Palatability: None

814 Ribes cereum inerme [Saxifragaceae]

815 Sambucus racemosa microbotrys (Rydb.)Kearney & Peebles [Caprifoliaceae]

816 Viburnum opulus sterile [Caprifoliaceae]

817 Lophocereus schottii Engelmann (Senita cactus) [Cactaceae]

818 Pachycereus pringlei (S.Wats.)Britt. & Rose (Cardon) [Cactaceae]

819 Pachycereus pectenaboriginum (Engelm.)Britt. & Rose (Hecho) [Cactaceae]

820 Lemaireocereus thurberi Engelmann (Organpipe) [Cactaceae]

821 Machaereocereus gummosus Engelmann (Agria) [Cactaceae]

822 Rathbunia alamosensis Britton & Rose (Cina) [Cactaceae]

823 Opuntia wilcoxii Britton & Rose [Cactaceae]

824 Cereus schotti Engelmann (Senita cactus) [Cactaceae]

825 Cereus thurberi (Organpipe cactus) [Cactaceae]

826 Lepidospartum squamatum [Compositae]

827 Gutierrezia microcephala Shinners [Compositae] Primary Use(s): None Palatability: Poisonous

828 Opuntia macrorhiza Engelmann [Cactaceae]

829 Cercocarpus parvifolius [Rosaceae]

830 Cercidium torreyanum Sarg. [Leguminosae]

831 Chrysothamnus graveolens (Nuttall)Greene [Compositae]

832 Artemisia dracunculoides (=A. dracunculus) Pursh (Falsetarragon sagewort) [Compositae]

833 Corylus rostrata Ait. (California hazel,beaked hazelnut) [Corylaceae]

834 Artemisia cana viscidula (Osterh.)Beetle (Mountain silver sagebrush) [Compositae] Primary Use(s): Browse

835 Artemisia cana cana Pursh (Silver sagebrush) [Compositae]

836 Cercis canadensis Linnaeus [Zygophyllaceae]

837 Morus spp. Linnaeus [Moraceae]

838 Cassia chamaecrista Linnaeus [Leguminosae]

839 Acacia amentacea DeCandolle [Leguminosae]

840 Acacia filicina Willd. [Leguminosae]

841 Larrea tridentata glutinosa Jepson [Zygophyllaceae]

842 Ambrosia psilostachya DeCandolle (Common or western ragweed) [Compositae]

843 Opuntia leptocaulis DeCandolle [Cactaceae]

844 Acacia farnesiana (L.)Willd. [Leguminosae]

845 Acacia berlandieri Bentham [Leguminosae]

846 Ambrosia aptera DC. (Giant ragweed) [Compositae]

847 Quercus stellata Wang. [Fagaceae]

848 Quercus marilandica [Fagaceae]

849 Lupinus bakeri Greene [Fabaceae]

850 Lupinus floribundus Greene [Fabaceae]

851 Lupinus caudatus [Fabaceae]

852 Lupinus argenteus (Silvery lupine) [Fabaceae]

853 Atriplex spinosa [Chenopodiaceae]

854 Salix babylonica Linnaeus (Weeping willow) [Salicaceae]

855 Lupinus amplus Greene [Fabaceae]

856 Baccharis texana [Compositae]

857 Chrysothamnus nauseosus turbinatus Hall & Clements [Compositae]

858 Prunus lyonii Sarg. (Catalina cherry) [Rosaceae]

859 Rhamnus crocea (Evergreen buckthorn) [Rhamnaceae]

860 Ceanothus crassifolius Torr. [Rhamnaceae]

861 Ceanothus cyaneus E.S. Clements [Rhamnaceae]

862 Ceanothus divergens Parry [Rhamnaceae]

863 Ceanothus gloriosus J.T. Howell [Rhamnaceae]

864 Ceanothus impressus Trelease [Rhamnaceae]

865 Ceanothus purpurea [Rhamnaceae]

866 Cotoneaster horizontalis (Trailing cotoneaster) [Rosaceae]

867 Syringa japonica [Oleaceae]

868 Syringa persica [Oleaceae]

869 Ceanothus griseus (Trelease ex Robinson)McMinn. [Rhamnaceae]

870 Ceanothus griseus horizontalis McMinn. [Rhamnaceae]

871 Ceanothus oliganthus [Rhamnaceae]

872 Ceanothus diversifolius [Rhamnaceae]

873 Ceanothus leucodermis Greene [Rhamnaceae]

874 Ceanothus lobbianus Hooker [Rhamnaceae]

875 Ceanothus americanus [Rhamnaceae]

876 Acacia longifolia [Leguminosae]

877 Celtis laevigata Willd. [Ulmaceae]

878 Tamarix articulata [Tamaricaceae]

879 Heteromeles arbutifolia Roemer (Christmas berry,toyon) [Rosaceae]

880 Eriogonum annum [Polygonaceae]

881 Lupinus pusillus Pursh [Fabaceae]

882 Lupinus sericeus [Fabaceae]

883 Salix cordata Muhl. (Pussy willow) [Salicaceae]

884 Salix lucida Muhl. (Shining willow) [Salicaceae]

885 Salix sericea Marsh. [Salicaceae]

886 Betula pumila Linnaeus [Betulaceae]

887 Betula nigra Linnaeus [Betulaceae]

888 Atriplex powelli S. Watson [Chenopodiaceae]

889 Atriplex patula hastata Hall & Clements [Chenopodiaceae]

890 Atriplex nuttallii falcata Jones [Chenopodiaceae]

891 Prunus virginiana demissa (Nuttall)Torr. [Rosaceae]

892 Lupinus chamissonis Esch. [Fabaceae]

893 Lupinus variicolor Steud. [Fabaceae]

894 Cercocarpus velutinus [Rosaceae]

895 Cotoneaster spp. [Rosaceae]

896 Acacia melanoxylon R. Br. [Leguminosae]

897 Eriogonum inflatum [Polygonaceae]

898 Acacia flexicaulis Bentham [Leguminosae]

899 Acacia wrightii Bentham [Leguminosae]

900 Artemisia californica Less. [Compositae]

901 Opuntia littoralis (Engelm.)Cockerell [Cactaceae]

902 Opuntia oricola Philbrick [Cactaceae]

903 Adenostoma fasciculatum Hook. & Arn. (Chamise) [Leguminosae] Primary Use(s): Browse Palatability: Moderate

904 Salvia californica Brandg. Jepson [Labiatae]

905 Salix fendleriana Anderss. [Salicaceae]

906 Artemisia heterophylla Nuttall [Compositae]

907 Prosopis odorata [Leguminosae]

908 Prosopis chilensis Stuntz. [Leguminosae]

909 Covillea tridentata (=Larrea tridentata) Vail [Zygophyllaceae]

910 Betula fontinalis Sarg. (Mountain birch) [Betulaceae]

911 Ribes grossularia Linnaeus (European gooseberry) [Saxifragaceae]

912 Ribes glutinosum [Saxifragaceae]

913 Acacia falcinella [Leguminosae]

914 Acacia maidenii [Leguminosae]

915 Acacia merralii [Leguminosae]

916 Cornus californica pubescens [Cornaceae]

917 Yucca filamentosa Linnaeus (Adam's needle) [Agavaceae]

918 Spiraea discolor Pursh [Rosaceae]

919 Adenostoma sparsifolium [Leguminosae]

920 Lonicera periclymenum [Caprifoliaceae]

921 Alnus glutinosa [Betulaceae]

922 Ribes nigrum Linnaeus (Black currant) [Saxifragaceae]

923 Juniperus scopulorum Sarg. [Cupressaceae]

924 Eriodictyon californicum Greene [Hydrophillaceae]

925 Alnus rubra Bong. [Betulaceae]

926 Pinus edulis Engelmann (Pinyon pine) [Pinaceae]

927 Ambrosia artemisifolia L. (Small ragweed,Western ragweed) [Compositae]

928 [Record Deleted]

929 Pinus monophylla Torr. & Frem. (Singleleaf pinyon pine) [Pinaceae]

930 Cassia bauhinioides Gray [Leguminosae]

931 Eriogonum abertianum [Polygonaceae]

932 Eriogonum rotundifolium Bentham [Polygonaceae]

933 Forestiera ligustrina (Michx.)Poir. [Oleaceae]

934 Yucca treculeana Carr. [Agavaceae]

935 Cercidium floridum Bentham [Leguminosae]

936 Haplopappus spinulosus (Pursh)DeCandolle [Compositae]

937 Ambrosia trifida (Giant ragweed) [Compositae]

938 Salvia farinacea [Labiatae]

939 Salvia coccinea [Labiatae]

940 Lupinus texensis [Fabaceae]

941 Rhus virens Lindh. [Anacardiaceae]

942 Berberis trifoliata Morie. [Berberidaceae]

943 Diplacus aurantiacus (Curtis)Jeps. [Scrophulariaceae]

944 Opuntia rufida Engelmann (Cinnamon prickleypear) [Cactaceae]

945 Opuntia subulata (Eve's-pin prickleypear) [Cactaceae]

946 Opuntia vulgaris (Irish mittens) [Cactaceae]

947 Echinocactus grusonii Hildm. (Golden barrel cactus) [Cactaceae]

948 Atriplex hortensis Linnaeus [Chenopodiaceae]

949 Quercus dunnii Kellogg [Fagaceae]

950 Pinus spp. Linnaeus [Pinaceae]

951 Opuntia vaseyi (Coulter)Britt. & Rose [Cactaceae]

952 Opuntia grandiflora Engelmann [Cactaceae]

953 Opuntia stenopetals Engelmann [Cactaceae]

954 Opuntia spinosissima Miller [Cactaceae]

955 Opuntia microdasys [Cactaceae]

956 Opuntia linguiformis Griffiths [Cactaceae]

957 Opuntia decumbens Salm & Dyck [Cactaceae]

958 Opuntia comonduensis (Coulter)Britt. & Rose [Cactaceae]

959 Opuntia leucotricha DeCandolle [Cactaceae]

960 Opuntia streptachantha Lemaire [Cactaceae]

961 Opuntia occidentalis Engelmann & Bigelow [Cactaceae]

962 Opuntia gosseliniana Weber [Cactaceae]

963 Opuntia dillenii (Ker & Gawler)Haworth [Cactaceae]

964 Opuntia santarita (Griffiths & Hare)Rose [Cactaceae]

965 Opuntia megacantha Salm & Dyck [Cactaceae]

966 Opuntia tomentosa Salm & Dyck [Cactaceae]

967 Opuntia azurea Rose [Cactaceae]

968 Opuntia scheerii Weber [Cactaceae]

969 Opuntia robusta Wendland [Cactaceae]

970 Opuntia pycantha Engelmann [Cactaceae]

971 Quercus turbinella californica Tucker [Fagaceae]

972 Rosa californica Willmott [Rosaceae]

973 Ceanothus spinosus Nuttall (Greenbark lilac) [Rhamnaceae]

974 Umbellularia spp. [Lauraceae]

975 Baccharis neglecta Nuttall [Compositae]

976 Rhus integrifolia Nutall (Lemonade berry) [Anacardiaceae]

977 Haplopappus drummondi Blake [Compositae]

978 Haplopappus coronopifolia DeCandolle [Compositae]

979 Eriogonum multiflorum Benth. [Polygonaceae]

980 Yucca whipplei Torr. [Agavaceae]

981 Encelia californica (California encelia) [Compositae]

982 Ambrosia acanthicarpa Hooker [Compositae]

983 Ambrosia confertiflora DeCandolle (Slimleaf bursage,slender ragweed) [Compositae]

984 Haplopappus squarrosus Hooker & Arnott [Compositae]

985 Ceanothus ovatus [Rhamnaceae]

986 Artemisia glauca Pallas [Compositae]

987 Artemisia caudata Michx. [Compositae]

988 Spiraea alba [Rosaceae]

989 Atriplex nutalliana [Chenopodiaceae]

990 Cereus spp. [Cactaceae]

991 Opuntia fulgida Engelmann [Cactaceae]

992 Opuntia arborescens [Cactaceae]

993 Opuntia cycloides Rose [Cactaceae]

994 Opuntia lindheimeri Engelm. (Giant opuntia) [Cactaceae]

995 Cereus giganteus Engelmann (Giant saguaro) [Cactaceae]

996 Cereus macrogonus Salm & Dyck [Cactaceae]

997 Opuntia elongata Haw. [Cactaceae]

998 Opuntia bernardina Engelmann [Cactaceae]

999 Echinocactus setispinus Engelmann [Cactaceae]

1000 Adenostoma spp. Hooker & Arnott [Leguminosae]

1001 Arctostaphylos drupacea Macbr. [Ericaceae]

1002 Arctostaphylos glauca Lindl. [Ericaceae]

1003 Artemisia rosea [Compositae]

1004 Atriplex expansa Wats. [Chenopodiaceae]

1005 Atriplex serenana Nelson [Chenopodiaceae]

1006 Baccharis pilularis consanguinea C.B. Wolf [Compositae]

1007 Berberis nervosa Pursh [Berberidaceae]

1008 Chrysothamnus paniculatus Hall [Compositae]

1009 Chrysothamnus viscidiflorus pumilus Hall & Clements [Compositae]

1010 Dalea californica S. Watson [Leguminosae]

1011 Dalea schotti Torr. [Leguminosae]

1012 Encelia frutescens frutescens [Compositae]

1013 Eriodictyon crassifolium Eastwood [Hydrophillaceae]

1014 Eriodictyon trichocalyx Heller [Hydrophillaceae]

1015 Eriogonum fasciculatum poliofolium S.G. Stokes [Polygonaceae]

1016 Eriogonum gracile Bentham [Polygonaceae]

1017 Eriogonum thomasii [Polygonaceae]

1018 Franseria acanthicarpa Coville [Compositae]

1019 Franseria bipinnatifidia Nuttall [Compositae]

1020 Franseria chamissonis bipinnatisecta (Less.)Cald. & Tayl. [Compositae]

1021 Franseria chenopodiifolia Bentham [Compositae]

1022 Haplopappus acradenius Blake [Compositae]

1023 Haplopappus cooperi Hall [Compositae]

1024 Haplopappus ericoides Hooker & Arnott [Compositae]

1025 Haplopappus pinifolius A. Gray [Compositae]

1026 Haplopappus propinquus Blake [Compositae]

1027 Haplopappus venetus vernonioides Munz [Compositae]

1028 Mahonia aquifolium (Shining barberry,Oregon grape) [Berberidaceae]

1029 Pluchea camphorata [Compositae]

1030 Pluchea foetida Britton Sterns & Pogg. [Compositae]

1031 Pluchea imbricata Nash. [Compositae]

1032 Pluchea purpurascens [Compositae]

1033 Prosopis juliflora torreyana L. Benson [Leguminosae]

1034 Salix goodingii Ball [Salicaceae]

1035 Sambucus glauca (=S. cerulea) Nuttall (Blueberry elder) [Caprifoliaceae]

1036 Viburnum tinus (Laurestinus viburnum) [Caprifoliaceae]

1037 Spiraea vetchi (Seedling) [Rosaceae]

1038 Haplopappus heterophyllus(=Icosoma wrightii) Blake (Jimmyweed) [Compositae]

1039 Haplopappus laricifolius A. Gray [Compositae]

1040 Franseria dumosa A. Gray (Bursage) [Compositae]

1041 Gutierrezia lucida Greene (Snakeweed) [Compositae]

1042 Tetradymia glauca [Compositae]

1043 Cornus racemosa Lam. (Gray dogwood) [Cornaceae]

1044 Arctostaphylos manzanita Parry (Common manzanita) [Ericaceae]

1045 Arctostaphylos viscida (R.L. Westcott) (White leaf manzanita) [Ericaceae]

1046 Acacia decurrens dealbata (Silvergreen wattle acacia) [Leguminosae]

1047 Acacia paucispina [Leguminosae]

1048 Cassia fistula (Goldenshower senna) [Leguminosae]

1049 Juniperus occidentalis (Western juniper) [Cupressaceae]

1050 Juniperus utahensis (=J. osteosperma) Lemmon [Cupressaceae]

1051 Eriogonum parvifolium [Polygonaceae]

1052 Ceanothus glinosus [Rhamnaceae]

1053 Ceanothus jepsoni Greene [Rhamnaceae]

1054 Salix nigra Marsh. (Black willow) [Salicaceae]

1055 Cotoneaster microphylla (Rockspray cotoneaster) [Rosaceae]

1056 Juniperus californica Carr. [Cupressaceae]

1057 Ambrosia chamissonis (Lessing)Greene (Silver beachweed,beach bur) [Compositae]

1058 Salix scouleriana Barrett in Hooker (Scouler willow) [Salicaceae]

1059 Chrysothamnus viscidiflorus typicus (Hall & Clem.)Cron. [Compositae]

1060 Forestiera acuminata (Swamp-privet) [Oleaceae]

1061 Baccharis angustifolia Michx. [Compositae]

1062 Salvia lanceolata Willd. [Labiatae]

1063 Clematis drummondi Torr. & Gray (Grandaddy gray beard) [Ranunculaceae]

1064 Acacia tortuosa [Leguminosae]

1065 Alnus tenuifolia (Mountain alder) [Betulaceae]

1066 Rhus glabra occidentalis Torr. [Anacardiaceae]

1067 Salix nuttallii Sarg. (Nuttall willow) [Salicaceae]

1068 Rhus diversiloba Torr. & Gray (Poison oak) [Anacardiaceae]

1069 Morus rubra Linnaeus (Red mulberry) [Moraceae]

1070 Salix sitchensis Sanson [Salicaceae]

1071 Cereus gigantea Engelmann (Giant saguaro) [Cactaceae]

1072 Echinocactus wislizenii Engelmann [Cactaceae]

1073 Mammillaria spp. [Cactaceae]

1074 Cereus polyacanthus [Cactaceae]

1075 Cereus fendleri Engelmann [Cactaceae]

1076 Ambrosia chenopodiifolia (Bentham)Payne (San Diego bursage) [Compositae]

1077 Ambrosia ilicifolia (Gray)Payne (Hollyleaf bursage) [Compositae]

1078 Salvia mellifera Greene [Labiatae]

1079 Berberis thunbergii DeCandolle (Japanese barberry) [Berberidaceae]

1080 Cassia nairobensis [Leguminosae]

1081 Cotoneaster franchetii [Rosaceae]

1082 Cotoneaster pannosa [Rosaceae]

1083 Cotoneaster parneyi [Rosaceae]

1084 Cotoneaster salicifolia [Rosaceae]

1085 Mahonia japonica (Japanese mahonia) [Berberidaceae]

1086 Philadelphus mexicanus (Mexican mockorange) [Philadelphaceae]

1087 Diplacus longiflorus [Scrophulariaceae]

1088 Lupinus arboreus [Fabaceae]

1089 Rubus nutkanus Moc. [Rosaceae]

1090 Eriogonum angulosum [Polygonaceae]

1091 Rhamnus douglasiana [Rhamnaceae]

1092 Agave schotti [Amaryllidaceae]

1093 Agave palmeri [Amaryllidaceae]

1094 Opuntia lata Small [Cactaceae]

1095 Opuntia stricta [Cactaceae]

1096 Opuntia arbuscula Engelmann [Cactaceae]

1097 Opuntia versicolor Engelmann [Cactaceae]

1098 Symphoricarpos rotundifoliae [Caprifoliaceae]

1099 Spiraea latifolia (Meadowsweet) [Rosaceae]

1100 Gutierrezia wrighti [Compositae]

1101 Rubus spectabilis Pursh (Salmonberry) [Rosaceae]

1102 Kunzia spp. (=Purshia spp.) [Rosaceae]

1103 Acer circinatum (Vine maple) [Aceraceae]

1104 Lonicera caprifolium Linnaeus [Caprifoliaceae]

1105 Spiraea salicifolia [Rosaceae]

1106 Quercus turbinata (Scrub oak) [Fagaceae]

1107 Opuntia tortispina [Cactaceae]

1108 Eriogonum arborescens [Polygonaceae]

1109 Eriogonum latifolium [Polygonaceae]

1110 Rhus toxicodendron Linnaeus (Poison ivy,poison sumac) [Anacardiaceae]

1111 Cassia polyantha Moc. & Sesse. [Leguminosae]

1112 Cassia wislizenii Gray [Leguminosae]

1113 Cassia bicapsularis Linnaeus [Leguminosae]

1114 Cassia spectabilis (Showy senna) [Leguminosae]

1115 Eriogonum jamesii (James wildbuckwheat) [Polygonaceae]

1116 Dryas integrifolia M. Vahl [Rosaceae]

1117 Eriogonum flavum (Yellow wild buckwheat) [Polygonaceae]

1118 Eriogonum kearneyi Tidestrom (Kearney wild buckwheat) [Polygonaceae]

1119 Eriogonum racemosum (Redroot wild buckwheat) [Polygonaceae]

1120 Lippia lanceolata Michx. [Verbenaceae]

1121 Lippia nodiflora (Mat lippia) [Verbenaceae]

1122 Lupinus parviflorus Nuttall (Lodgepole lupine) [Fabaceae]

1123 Ribes divaricatum Doulgas (Straggly gooseberry) [Saxifragaceae]

1124 Rubus chamaemorus Linnaeus (Cloudberry) [Rosaceae]

1125 Vaccinium uliginosum (Bog bilberry) [Ericaceae]

1126 Yucca constricta (Buckley yucca) [Agavaceae]

1127 Eriogonum ovalifolium depressum Blankinship [Polygonaceae]

1128 Salix fragilis [Salicaceae]

1129 Arctostaphylos tomentosa [Ericaceae]

1130 Arctostaphylos mumularia [Ericaceae]

1131 Clematis paniculata [Ranunculaceae]

1132 Garrya elliptica [Garryaceae]

1133 Heteromeles spp. [Rosaceae]

1134 (Not examined, plant species undetermined)

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A computer-generated compilation of bibliographic and collection information about insects associated with wildland shrubs in the Western United States. Various listings and indexes are provided to allow location of information according to subject, title key word, author, insect common names, scientific name, family, order, or guild, and plant scientific name, common name, or family.

KEYWORDS: range entomology, rangeland shrubs, bibliography, insect collections

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Management of Pinyon-Juniper Woodlands

Raymond A. Evans

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This publication reports research involving pesticides. It does not contain recommendations for their use, nor does it imply that the uses discussed here have been registered. All uses of pesticides must be registered by appropriate State and/or Federal agencies before they can be recommended.

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Intermountain Research Station
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PREFACE

I wish to acknowledge the writings of many authors from whom I obtained background information for this manual. The principal sources of information are listed in the "References" section of this publication. Specific references to information in the text are not quoted for ease of reading and understanding by the users of this manual. Scientific names of plants, animals, and birds are not used in the text but are listed in appendix 1.

Every effort was made to make this manual a usable synthesis of current knowledge of pinyon-juniper woodlands. I hope this manual, although general in nature, presents principles that will serve as a basis for better understanding of local conditions and site-specific information.

I also wish to acknowledge the willing assistance of Forest Service scientists and technical personnel in gathering information for and reviewing of this manual. Particular thanks is extended to R. Duane Lloyd and Richard L. Everett of the Intermountain Research Station, James A. Young of the Agricultural Research Service, U.S. Department of Agriculture, and Steven Jenkins of the Biology Department, University of Nevada, Reno for their helpful suggestions and assistance throughout the preparation of this manual.

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RESEARCH SUMMARY

The pinyon-juniper woodlands are extensive in the Western United States and are a valuable renewable resource for many uses: livestock grazing, fuelwood harvesting, pinyon nut gathering, wildlife habitat, and a source for poles, posts, Christmas trees, and other home decorations. Such uses have made the pinyon-juniper woodlands an important part in the historical past of the West, and they remain so today.

Past use and misuse of these woodlands have left many areas in the pinyon-juniper woodlands degraded. Recently, there has been an awakening and a realization of the need for better management of these woodlands by land management agencies. For example, forage production for livestock is low, and although improved grazing management and range improvement technologies have been developed, they are not being used in many areas. Wildlife habitat needs improvement in specific areas of the pinyon-juniper woodlands, but criteria need to be applied as to what areas to improve and what methods to use. More information is needed on watershed characteristics and how the use and management of the woodlands is affecting them. Management for fuelwood production and harvesting needs improvement, and new and unique ways to more efficiently use the potential resource of forest products should be given greater emphasis.

At the Pinyon-Juniper Conference held in 1986 at Reno, NV, knowledgeable scientists from universities and government agencies presented reports forming a comprehensive array of knowledge from which to manage these woodlands more intelligently. The proceedings of that conference and many other sources served as a basis for this manual. The objective is to give land managers and natural resource students a general knowledge, emphazing principles by which they can more fully understand and better manage the pinyon-juniper woodlands.

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Management of Pinyon-Juniper Woodlands

Raymond A. Evans

THE PINYON-JUNIPER ECOSYSTEM

Pinyon-juniper woodlands occupy more than 47 million acres in the Western United States. The woodlands occur primarily on foothills, low mountains, mesas, and plateaus at elevations from 4,000 to 8,000 ft. In higher mountains, pinyons and junipers usually occur at midelevational levels and may be confined to certain slopes depending on moisture and temperature regimes (fig. 1).

The pinyon-juniper woodlands, as a vegetation type, tolerate a wide range of environmental extremes. Average monthly temperatures can vary from 14 °F in January to 95 °F in July. Frost-free growing seasons average 120 days. Cloudy days are rare and relative humidity is extremely low, resulting in high potential evapotranspiration. Average annual precipitation varies from 10 to 20 inches. Storms tend to be infrequent but can be intense, contributing to rapid runoff and erosion.

Soils of pinyon-juniper woodlands are derived from a variety of parent materials and are typically shallow, well drained, and low in fertility. The typical low vegetation cover and the high proportion of bare soil contribute to highly erodible soil conditions.

The States with extensive acreages of pinyon-juniper woodlands are in the Intermountain area, Utah, Colorado, Nevada, eastern Oregon, and eastern California; and in the Southwest, Arizona and New Mexico.

Among these areas the woodland varies widely with different tree species, different shrub species, and different herbaceous understory. The varied plant communities and habitat types present a vast array of differences within the range of the pinyon and juniper ecosystem.

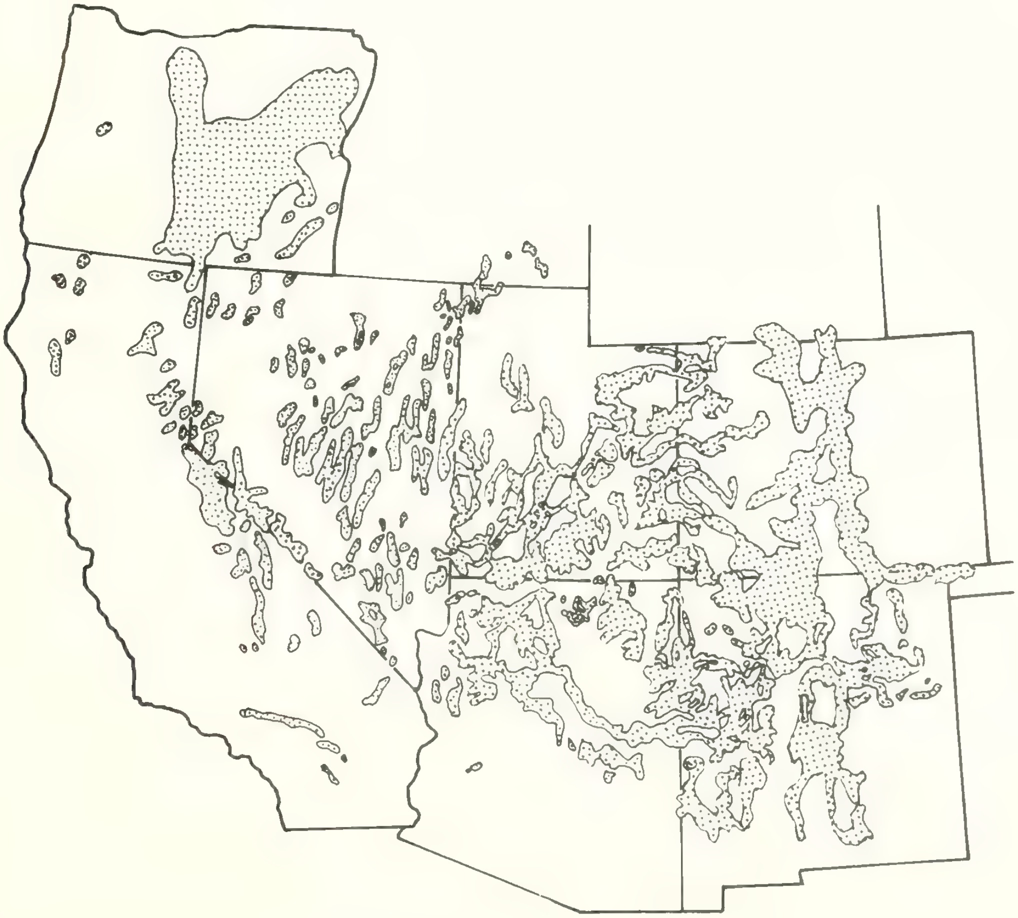

Figure 1—Distribution of pinyon-juniper woodlands in the Western United States.

In the Intermountain area, singleleaf and two-leaf pinyons (see appendix 1 for scientific names of plants, animals, and birds mentioned in this publication) occur along with Utah, western, and Rocky Mountain junipers as the overstory trees, and the shrub layer is composed of such species as mountain big sagebrush, antelope bitterbrush, and Gambel oak. In eastern Oregon and northeastern California the woodlands are characterized by western juniper with the absence of pinyon.

In the Southwest, two-leaf pinyon dominates with limited distribution of Mexican pinyon in southeastern Arizona and southwestern New Mexico. In the northern and central areas oneseed and alligator junipers dominate, with Utah and Rocky Mountain junipers. The shrub layer is characteristically a mixture of hard-leaf species including manzanita, scrub live oak, and yucca (see appendices 2 and 3 for characteristics of pinyon and juniper species).

Herbaceous understory in pinyon-juniper woodlands varies tremendously both in species composition and cover depending on general area, elevation, and tree and shrub cover. On different sites, cool-season or warm-season grasses with a mixture of forbs may occur.

Pinyon-juniper woodlands consist of relatively few tree species, but stands exhibit considerable diversity in appearance and composition. Some stands have closed canopies of single or many tree species, with little or no understory vegetation. Other stands, in contrast, are open with widely scattered junipers or pinyons or both, with a wide variety of shrubs and herbaceous species in a well-developed understory.

This woodland type can consist of stands of all ages or of one age, depending on the history of the area. Even-aged stands characteristically occur as a result of some catastrophic event such as fire or as a result of clearcutting.

At lower elevations and on drier sites, pinyons and junipers tend to be short and bushy with sprawling crowns, and juniper species tend to dominate most stands. At higher elevations and wetter sites, trees are single stemmed and tend to reach their maximum heights. In these areas, pinyon species tend to be the dominant tree. On high-potential sites, some pinyons and Rocky Mountain juniper may reach heights of 50 ft and stem diameters of 30 inches. Western juniper on good sites may also be a good-sized tree. Site potential may affect composition and growth of understory species as well as tree stand characteristics.

Ecological Effects of Past Use

Historical use of pinyon-juniper woodlands has had a profound impact on stand structure and understory characteristics. Use by early homesteaders was similar in the Southwest and the Intermountain areas with regard to grazing of domestic animals and the use and consumption of woodland products, such as cutting trees for fuel and posts and gathering nuts for food. However, use of the woodlands began in the 1600's in the Southwest following Spanish colonization, whereas in the Intermountain area, settlement did not occur until the mid-1800's. Consequently, grazing impacted and altered the development of plant communities differently in the two regions. The general effect of intensive livestock grazing was to so deplete and weaken stands of grass and palatable forbs that their competitive effect on new and establishing tree seedlings was slight. Further, this impoverished understory vegetation could no longer carry fire. With plant communities in this low seral condition, trees increased in density and encroached onto grassland sites.

The earlier introduction of livestock grazing in the Southwest provided trees with nearly 300 more years of increased competitive advantage over understory species, while in the Intermountain area only 100 years of grazing has occurred. Because of this, stands in the Southwest are likely to be older, denser, and with a wider range of age classes than those in the Intermountain area.

In a similar manner, a major difference in commercial use of the woodlands existed between the two regions. Large acreages of trees were not cleared in the Southwest in the historical past. Heavy cutting was confined to local areas to provide fuel for military installations and to provide railroad ties, structural timbers, and limited fuel for the early mining industry. One area where trees were cut for mining purposes was in the Tombstone Mining District of Arizona.

In the Intermountain area, especially Nevada, vast areas of woodland were cut because of the mining boom during the latter part of the 19th century to provide wood for kilns producing charcoal so vital to the ore-smelting process. Because of wide deforestation of pinyon-juniper woodlands, particularly in Nevada, herbaceous plant communities had an advantage over trees with regard to their development.

Because of past overgrazing and deforestation, a great proportion of the existing plant communities are neither climax or near-climax. The pinyon-juniper communities of today are in a real sense the result of past human activity more than natural ecological processes.

Climatic Factors and Distribution

Pinyon-juniper woodlands occur predominantly on foothills, low mountains, mesas,and plateaus, and form bands of trees along mountain ranges at elevations of 4,500 to 7,500 ft in the Southwest and at slightly higher elevations in the Great Basin. The elevations that these woodlands inhabit are commonly intermediate between the more xeric brush and grass-dominated types found below and the more mesic montane forests, usually ponderosa pine-dominated but sometimes with Douglas-fir, lodgepole pine, or other coniferous species, found above them. However, in the Great Basin paleoecological influences have prohibited development of montane forests. Mountain brush types are found instead. Elevational distribution of trees varies according to precipitation and temperature regimes in specific areas. In general, the lower elevational limits are controlled by limited soil water and upper limits by unfavorable temperatures. In some cases, both lower and upper limits of distribution are established by unfavorable temperature regimes. For example, in the Virginia Range of western Nevada the pinyon-juniper woodlands seem to be confined to a thermal belt above the valley inversions and below the colder upslope elevations.

Elevation appears to be the most important topographic feature influencing climate and, in turn, stand structure and tree size in pinyon-juniper woodlands. Pinyon pines dominate at higher elevations and junipers at lower. Aspect is confounded by other variables, but usually the more mesic species occupy north-facing slopes and xeric species the southern exposures. There is a tendency for the communities to be restricted to northern aspects in the southern Great Basin and to be equally restricted to southern exposures in the northern Great Basin. However, there are many exceptions. For instance, western junipers are found on all aspects in the northern Great Basin and in northeastern California and eastern Oregon. Also, in the mountains immediately east of the Sierras in Nevada, pinyon- juniper distribution is not restricted by aspect. Distribution is more a reflection of ecological amplitude and response to available soil water and temperature regimes than to a general topographic relationship of the woodlands as a whole.

Soils

Pinyon-juniper woodlands occur on a wide variety of soils derived from a diverse array of parent materials including granites, limestone, volcanics, basalt, sandstone, and mixed alluvium. Soil depths vary from shallow to moderately deep with generally low to moderate fertility levels. Soil textures range from the coarse, rocky, porous types to fine compacted clays. Soil orders that are represented within this woodland are Aridisols, Entisols, Mollisols, Vertisols, Alfisols, and Inceptisols (see appendix 4 for descriptions of soil orders).

Only a few comprehensive soil and soil-vegetation studies have been conducted in the pinyon-juniper woodlands. Most of the present knowledge is only of the most general nature. It is important, however, that more specific knowledge be obtained to use as a basis for classification of vegetation and effective environments in these woodlands. For instance, the soil series, by definition, is a soil classification unit that consists of individual pedons with a high degree of similarity of all properties, indicating a uniform effective environment. It would be highly desirable, at least in localized areas, to classify and map soils to the series level to ensure a more valid basis for habitat type classification.

A comprehensive, Basin-wide, soil-vegetation study conducted in Nevada and Utah indicated that current climate is a more dominant factor than are soils in delimiting the Basin-wide and elevational distribution of pinyon-juniper woodlands. Also, vegetation and soils differ considerably in their response to climate. The present vegetation has had only a minor effect on soil development. This phenomenon often occurs in arid and semiarid climates because of sparseness of vegetation, frequent and rapid erosion, and long periods required for soil development in these environments.

Paleoecological and present evidence indicates that the vegetation zonation of the Great Basin has been much more dynamic than soil development. Because of climatic shifts and the influence of human activities, plant communities have shifted both in terms of elevation and latitude with relative ease and speed. Because of this, some researchers believe that soil classification units and soil diagnostic horizons are of limited value in differentiating synecological divisions of the woodlands over large areas.

However,when localized areas are considered, soil differences can be a significant factor in altering the effective environments of plants. Thus, classification of soils will markedly aid differentiation of range types and will facilitate classification and inventory of pinyon-juniper woodlands.

Inventory and Classification

Pinyon-juniper woodlands are extensive and diverse in stand characteristics. Density, canopy cover, and botanical composition of both overstory and understory vary according to influences of temperature and water regimes. These in turn are influenced by latitude, elevation, topography, aspect, and soils.

INVENTORY AND CLASSIFICATION SYSTEMS

Inventory and classification of the pinyon-juniper woodlands are essential for understanding the complex plant associations enough to intelligently manage for current and future uses of the resource. Uniformity in vegetation sampling techniques will provide consistency in classifying pinyon-juniper plant associations among locations and among agencies as well as in assisting in making reliable management interpretations, using research information efficiently, and exchanging information.

Communities of pinyon-juniper woodlands may consist of an overstory of trees with a simple understory, or they may consist of a tree overstory with a well-developed understory of shrubs and herbaceous vegetation. The nature of vegetation alone in these communities makes it too imprecise to indicate areas of similar environments and to indicate similarity in management response. Because of the difficulty in identifying similar climax pinyon-juniper communities on vegetation alone, classification of communities and their effective environments should take into account climate, soils, and vegetation together. The ideal inventory method, then, would include these three and the factors that affect them. And the most important of such potentially altering factors in pinyon-juniper woodlands is elevation, followed by aspect, slope, longitude, latitude, landform, and geologic substrate.

Meaningful classification can be accomplished when basic climate-soil-vegetation relations are understood. However, these relations are difficult to interpret in pinyon-juniper woodlands because of the simplicity of the vegetation and because the dominant species are wide ranging and have broad ecological amplitude in relation to where they can and cannot grow.

One classification system developed by the Forest Service for Arizona and New Mexico combines climate, soils, and vegetation (Moir and Carleton 1986). On this basis, 70 plant associations with 280 ecological sites can be differentiated in pinyon-juniper woodlands of that area. Another striking example of an inventory and classification system of wildlands based on soil-vegetation relation is the Cooperative Soil-Vegetation Survey in California, which is conducted by the Forest Service, California Division of Forestry, and the University of California (California Department of Forestry 1980). In this survey, soil-vegetation units are classified and mapped. These units are readily identified, recognizable, and usable in management of forests and rangelands.

Classification systems for pinyon-juniper woodlands should form the physical-biological basis for recommending best use of the woodlands, whether it is to produce wood fiber or pine nuts, to produce forage for livestock production, to provide suitable wildlife habitat, to stabilize watershed and lessen erosion on a specific area, or to combine these objectives.

REMOTE SENSING

Remote sensing, usually consisting of photography from airplanes or satellites, holds much promise in the identification and mapping of vegetation in pinyon-juniper woodlands. Researchers are developing and testing many applicable remote-sensing techniques that, when coupled with computer processing, can be of great value in inventory and classification of pinyon-juniper woodlands. Currently, a valuable application of this technology is to monitor changes in canopy cover or invasion of trees into adjacent communities.

VOLUME AND GROWTH PREDICTION

Land managers administering large acreages of pinyon-juniper woodlands need information on tree volume and growth. They cannot get this information by readily accessible direct measurements. One solution is to use mathematical models to predict volume and growth from readily measurable variables, such as tree diameter, height, and crown dimensions.

Gross cubic foot volume equations are available for pinyon-juniper and several other woodland species in the central Rocky Mountain States including Nevada, Idaho, Utah, Colorado, and Wyoming. The volume equations are based on data collected as a subsample of woodland inventories conducted by Federal and State land management agencies. Use of the equations requires measurement of a tree's diameter at the root collar (DRC), total height, and number of basal stems. Current annual volume growth rate or average annual volume growth rate is best modeled as a function of total crown volume, total basal area growth, and percentage juniper crown cover (see appendix 5 for example volume and growth equations in pinyon and juniper). In addition, a site index equation has been developed from a relationship between tree height and diameter.

PINYON-JUNIPER RESOURCES, USES, AND VALUES

Uses—past and present—of the pinyon-juniper woodlands in the United States reflect the products and values that have changed from one people and their culture to the next people coming to live in or use these resource-rich areas.

Historical Uses

Pinyon-juniper woodlands have been used by people for the past 20,000 to 30,000 years. First, the American Indians used these lands and the products that they yielded. Then the Spanish and southwestern settlers came, and in the 19th century, the miners and ranchers depended on these woodlands for forage, fuel, and building material.

The way of life of the Indians of the Southwest and the Great Basin areas was directly tied to the harvest of pinyon nuts. In many years, their very survival depended on collecting and eating pinyon nuts. For many tribes, a winter without an adequate cache of pinyon nuts was a disaster.

In addition, the Indians of the region extensively used trees from pinyon-juniper woodlands for fuelwood. They used these trees for poles and roof beams and as material to make tools and other domestic implements. The branches were used to construct corrals for trapping wild animals and the pitch from trees was used to make glue for jewelry and for medicinal purposes.

The early Southwest settlers had high regard for the pinyon-juniper woodlands. The pinyon was their traditional Christmas tree. Pinyon and juniper foliage was used as decorations many times a year. These settlers used pinyon and juniper trees for fuelwood and building material for their homes, corrals, and fences.

Perhaps the most important historical use of pinyon and juniper trees in the Great Basin occurred in the mid-1800's when silver was discovered in Nevada. The requirements for firewood and fuel to smelt the ore were staggering, and in much of the area surrounding the mining towns whole forests were denuded. To smelt a ton of ore required 30 bushels of charcoal, which, to produce, took one cord of wood. In a year the hills were bare within 10 miles around the towns and mines, and in 5 years the charcoal makers were forced to travel 50 miles or more to get wood.

Despite the great demand for charcoal in smelting of silver, the use of pinyon and juniper wood for home heating and cooking and fence and corral building on the ranches in the Great Basin probably had a greater overall impact on the woodlands. This extensive use of pinyon-juniper woodlands for fuelwood and posts extended well into the 20th century. It wasn't until after World War I that the Great Basin gradually became dependent on fossil fuels for energy, thereby lessening the demand and use of pinyon and juniper wood.

Present-Day Forest Products

Because of the increased demand and the general awareness of the potentials of the pinyon-juniper woodlands, public land management agencies are placing more emphasis on utilization and revenue return from the harvest of fuelwood and other products that can be gleaned from these woodlands.

FUELWOOD

Today, fuelwood remains the most important forest product derived from pinyon-juniper woodlands. Private individuals and commercial operators cut and haul pinyon and juniper wood in increasing amounts because of the higher price for fossil fuels, especially oil and gas for home heating, and the increasing population of the Western States (fig. 2).

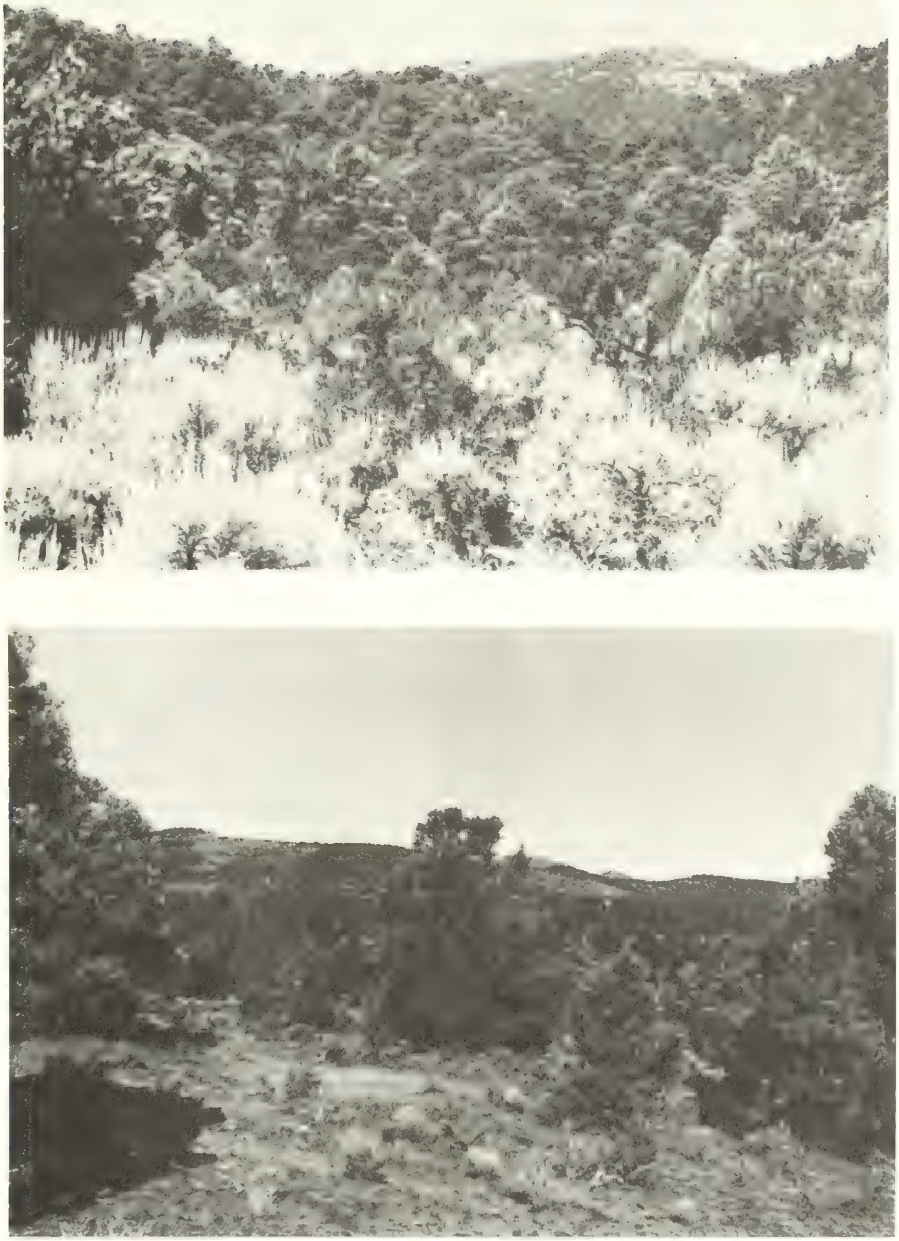

Figure 2—Productive pinyon-juniper woodlands near Reno in western Nevada are used for fuelwood cutting, pinyon nut gathering, and Christmas tree harvesting. (Photos by J. A. Young, Agricultural Research Service, U.S. Department of Agriculture, Reno, NV.)

Some agencies administering pinyon-juniper woodlands have been selling wood harvesting permits since the 1940's. Others have not until more recently because fuelwood cutting and nut gathering have been on a free basis and, apparently, agency policies have varied widely. Also, more important, these woodlands have probably not been considered a usable resource except for grazing.

Results of a recent survey of 20 land management agencies show that 11 have been selling permits for forest products for an average of 16 years. The responses among agencies varied from 3 to 45 years indicating a large disparity of policy. This survey also points out the importance of forest products today in terms of revenue for land management agencies. The sales of these products totaled $900,000 annually, an amount that is not trivial and probably represents a break-even return on the management of these lands.

A recent study of fuelwood cutting in Colorado reports that about 41,000 cords were harvested from woodland trees in 1982. Over two-thirds of this harvest was pinyon, all of which came from dead trees. Also, 22 percent was harvested from live juniper trees. Interestingly, the total deadwood harvest for 1982 from the woodlands represented only 1 percent of the total salvable dead volume available.

Much of the pinyon and juniper harvesting occurs in areas that were chained for land conversion or where road construction has pushed over trees. The accelerated harvesting since the 1970's has depleted much of this supply. Today, people are having to drive longer distances or are forced to cut green trees that require aging before use.

When people are forced to cut green trees for fuelwood harvesting, most want to select larger trees in older stands because the wood can be harvested more efficiently. In like manner, the cutting of pinyon is preferred over juniper because juniper trees with many branches close to the ground are difficult to cut and trim and much effort is expended per tree.

Most of the pinyon and juniper are economically unavailable for fuelwood harvest because of long distances to market or physical difficulties, such as steep slopes or distance from roads. Currently, pinyon-juniper woodlands distant from large population centers are seldom used. For example, the Caliente area of Nevada has an estimated potential harvest of 12,000 cords annually, but only 800 cords are harvested.

Results of a study in northeastern California indicated that harvesting even-aged stands of large western juniper trees for fuelwood was not economically feasible because the nearest market is 120 miles away. When ranchers used the fuelwood locally it was to their economic advantage to cut and harvest junipers and to pack wood home for heating and cooking instead of flicking a switch or turning a knob.

Pinyon is preferred over juniper for fuelwood harvesting not only because it is easier to harvest but because it generally sells for more on the market. In Salt Lake City, UT, pinyon sells for $10 to $15 more per cord than juniper. There are exceptions where juniper is preferred over pinyon. For example, in Las Vegas, NV, many people prefer juniper wood, creating much activity in harvesting it.

The bulk of permits issued by Federal agencies is for private fuelwood harvesting. Families often combine an opportunity for recreation in the out of doors with the cutting of fuelwood. There is a sense of satisfaction derived from harvesting one's own wood and enjoying the fruits of that labor on cold evenings. Although fuelwood harvesting is directly affected by the price of gas and oil for home heating, there are other variables that we must consider when projecting future use of these woodlands as an energy source. The opportunity to get out in the woods either with the family or friends, the esthetic and entertainment values to burning an open fire either in a fireplace or wood-burning stove, and the ever-increasing population in the Western States all have a direct influence on the pinyon and juniper harvest.

In a recent survey, 80 percent of the agencies expecting to generate future revenues on pinyon-juniper woodlands predicted that these would increase slightly in the future. The others expected their income to remain stable over time. These are, in my opinion, conservative evaluations of future trends in the use of the pinyon-juniper woodlands considering population trends, fossil fuel prices, and the people's desire to be out of doors. In Arizona, fuelwood demand increased sharply during the mid-1970's, and an upward trend in use is predicted along with the growth in population.

PINYON NUTS

Pinyon nut harvesting is probably the second most important forest product from pinyon-juniper woodlands both for commercial and noncommercial uses. Each year 1 to 2 million lb of nuts are harvested by commercial operators. In some years the harvest has exceeded 8 million lb. The nut crop is uncertain and tends to be heavy in localized areas so that the average production per acre is meaningful only over a large area.

CHRISTMAS TREES

Christmas trees are an important product of the pinyon forests. Some good Christmas tree harvest sites are in areas that were chained, burned, or otherwise treated 20 to 30 years ago. Both commercial and personal-use harvest of Christmas trees is common, with an estimated 500,000 trees cut annually. Pinyon is the only woodland tree used as Christmas trees. The desired height of trees at time of harvest is 6 to 10 ft. As with fuelwood harvesting, Christmas tree cutting is combined with a recreational outing, and the heaviest cutting is near cities.

POSTS AND POLES

Historically, the use of juniper trees for fenceposts, poles, and railroad ties has been important in the settling of the Southwest and the Great Basin. Today, woodland tree species, predominantly juniper, are often cut for fenceposts. In Colorado there are an estimated 110 million usable corner and line posts in juniper trees on State and private woodlands. Juniper is a durable wood that makes it ideally suited for posts and poles. In a 50-year study at Oregon State University, western juniper was the most durable post. Pinyon is not commonly used for fenceposts.

OTHER PRODUCTS

Results from recent pilot tests indicate that current costs of chipping and hauling are too high to make the production of particleboard or paper from pinyon and juniper trees economically feasible. Production of cement board, composed of 60 percent cement and 20 percent wood fiber, shows promise for a variety of construction uses when the building industry is strong. The potential for naval stores production from pinyon and juniper is promising because the branches and needles of these trees contain four times more resin than Douglas-fir.

Livestock Grazing

Livestock grazing is a major use of the pinyon-juniper woodlands. About 80 percent of the total area is grazed, supporting 1 to 1.5 million animal unit months (AUM's) of grazing. In 1972, livestock use on woodland ranges in the National Forests of Arizona and New Mexico was 630,000 AUM's for cattle and 140,000 AUM's for sheep. Sheep were once much more numerous, but their numbers have declined drastically since World War II.

Pinyon-juniper woodland ranges have been grazed by domestic livestock for over 200 years, and some have been grazed since livestock were brought by the explorer Coronado in 1540. Historically, these rangelands have been grazed yearlong—and many still are—because of the relatively mild climate, especially in the Southwest. These lands are generally in poor condition and have carrying capacities averaging as low as 0.03 AUM's per acre. In the Southwest, carrying capacity is generally higher than in other areas of the pinyon-juniper woodlands.

The generally low carrying capacity of pinyon-juniper rangelands has been attributed to continuous and often heavy grazing with little or no concern for the needs of the forage and browse plants. Low carrying capacity is also associated with increased tree density and the invasion of trees into grasslands.

Wildlife Habitat

Deer is a dominant animal and the most important game species found in the pinyon-juniper woodlands. In many parts of the West, mule deer depend heavily upon these lands for cover, shelter, and feed during the winter. The deer diet consists of juniper foliage, shrubs, forbs, grasses, and lower plants. The diet composition changes throughout the year. In winter, shrubs and trees make up the bulk of the diet. In spring, the consumption of forbs and grasses increases, making up about half of the diet. In summer, forb consumption increases and grass in the diet decreases, and shrubs and trees remain at about the same level. Juniper foliage intake varies among species and among individual trees.

The most palatable shrubs for deer are antelope bitterbrush, alderleaf or birchleaf cercocarpus, and Stansbury cliffrose. In areas where the only shrub is sagebrush, studies have shown that sagebrush makes up as much as 80 percent of the deer diet in October.

Published information on elk use of the pinyon-juniper woodlands is scarce compared to that for deer. In Utah, elk make considerable use of these woodlands in winter, especially where *Cercocarpus* spp. and other palatable shrubs occur with the pinyon and juniper. Some use of these woodlands has been reported in Wyoming and Colorado. In general, elk are usually found where there is a mixture of shrub species upon which they browse in the winter.

Wild horses use pinyon-juniper woodlands extensively in various parts of the West. Horses graze on south-facing slopes in winter and often eat such shrubs as Stansbury cliffrose, antelope bitterbrush, sagebrush, and rabbitbrush in the fall. Certain rehabilitated areas that have been seeded to grasses are used heavily by horses year round.

Such game animals as desert bighorn sheep, buffalo, and pronghorn antelope are found in the pinyon-juniper woodlands in specific areas and at certain times of the year.

The major predator in these woodlands is the mountain lion, which primarily feeds on deer. Coyotes are also a factor in deer predation. Predators of small animals include bobcats and badgers. Porcupines, rabbits, and small mammals, such as mice, voles, woodrats, and squirrels, also reside in the woodlands.

At least 75 species of birds are associated with pinyon-juniper woodlands. Some are permanent residents and some are summer or winter residents, depending upon location. Among the plentiful birds found in the woodlands are about a dozen raptors including bald and golden eagles, hawks, owls, kestrels, and falcons. Each kind of bird found in these woodlands has one or more characteristic differing from other birds that enables it to survive in competition with the others. These include differences in obtaining food, nesting incubation periods, and other adaptive characteristics.

Both pinyon and juniper trees in the woodlands provide food for many wildlife species that eat the highly nutritious seeds. A mutualistic relationship exists between the trees that produce food and the animals that eat and disperse seeds, thereby ensuring perpetuation of the woodlands.

Juniper berries are more consistently available than pinyon nuts. The berries remain on trees a large part of the year, and they are more resistant to insect destruction than pinyon nuts. For these reasons junipers often invade adjacent plant communities first followed by pinyon. Many species of birds and small animals disperse seeds of pinyon and juniper, providing the seed source for expansion of these woodlands.

Watershed and Hydrologic Values

The hydrology of pinyon-juniper woodlands is complex because it represents a wide range of interactions among local precipitation regimes, past land use or misuse, and varied geomorphological and soil conditions. Hydrologic conditions in the woodlands range from a desirable combination of low-intensity rainstorms, good vegetative cover, and permeable soils to the worst case of steep slopes, poor vegetative cover, and impermeable soils coupled with high-intensity rainstorms. The heterogeneity of vegetation cover alone makes it difficult to generalize as to watershed characteristics and hydrologic dangers. The great variation in soils, with their different infiltration rates, in these woodlands also complicates the hydrology of this vegetation type (fig. 3).

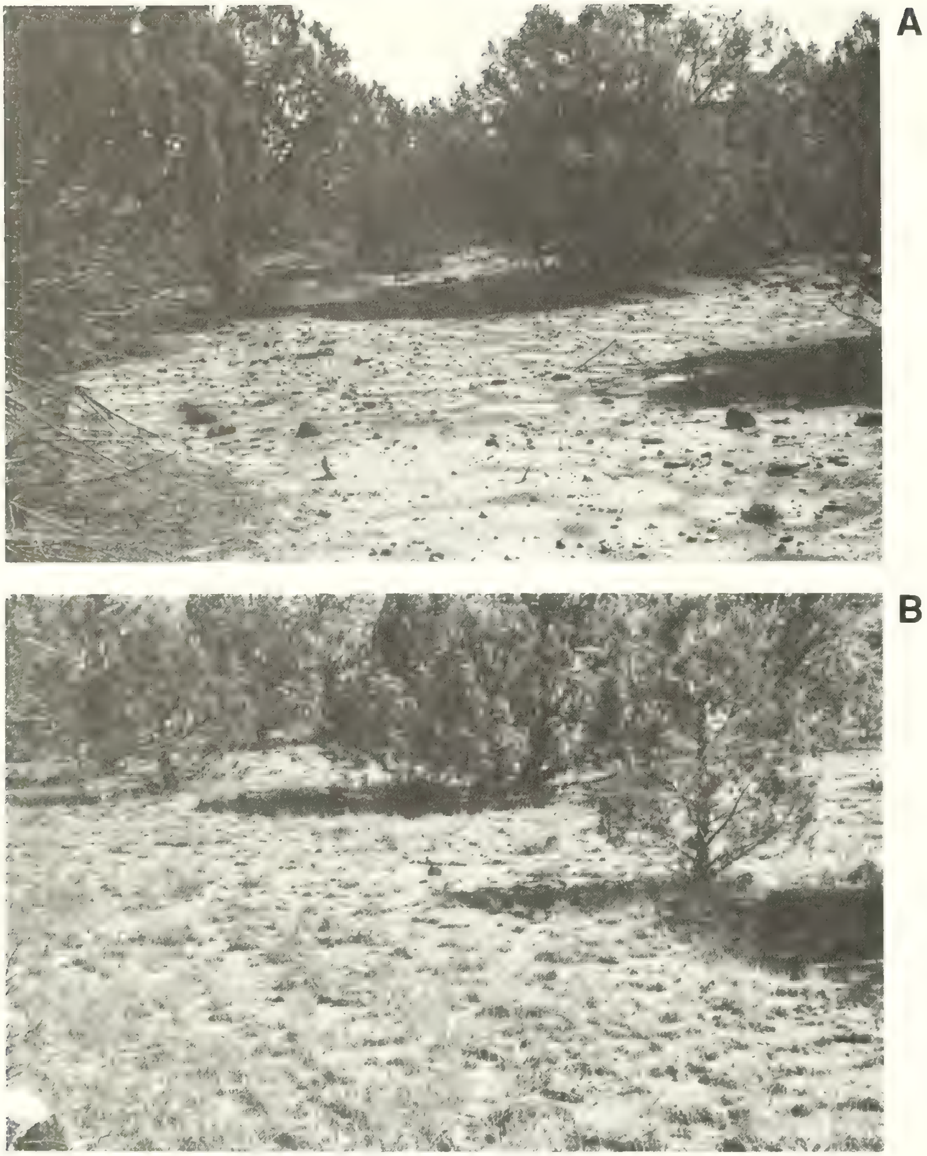

Figure 3—(A) This juniper woodland site in north-central Arizona exhibits extensive sheet erosion. Area is devoid of grass cover even though ungrazed for 20 years. The soil is a clay loam with slow permeability. (B) An adjacent juniper woodland site has grass cover. Note the lack of erosion although this site has similar soil and slope characteristics. (Photos from T. N. Johnsen, Jr., Agricultural Research Service, U.S. Department of Agriculture, Tucson, AZ.)

Total precipitation is relatively low in the pinyon-juniper woodlands. Most storms cause little or no runoff, especially where a combination of desirable hydrologic characteristics exists. However, high-intensity, short-duration storms produce runoff that can be significant when coupled with less desirable hydrologic conditions such as steep slopes, sparse ground cover, and soils of low permeability.

In many cases, the hydrology of pinyon-juniper woodlands is highly sensitive. Excessive rates of runoff and sediment are produced because of overgrazing or other past misuse. Now the prospect for even greater use of the woodlands magnifies the hydrologic problems. The lack of a comprehensive base of knowledge because of the limited research done on the land's hydrology further complicates the watershed picture.

Recreational Activities

More and more people head for pinyon-juniper woodlands for their recreational pursuits. Recreation in these woodlands is as varied as the people pursuing it. People on an outing in the woods to harvest firewood or to gather pinyon nuts, a family claiming their native Christmas tree, the hunter, the birdwatcher, the hiker, and the nature-lover all enjoy these woodlands. More recent recreational pursuits include use of off-road vehicles which exemplifies one of the growing problems in management.

Cultural Values

A dichotomy of cultural values and actions toward the woodlands exists between the American Indian and the

Caucasian. According to archeological findings, the American Indians have lived in harmony with these woodlands for about 30,000 years. During this time, the Indians have sustained themselves by harvesting pinyon nuts and other products from the woodlands for their food and shelter. In all this time, their actions have not appreciably disturbed or changed the character of the woodlands. The Indians would like to see their ancestral homeland left undisturbed or at least used in such a way that the land's integrity would be preserved.

On the other hand, the thinking and actions of Caucasians have evolved, somewhat dramatically, over their short time on these lands through successive waves of people and interests. The pinyon-juniper woodlands were used to a small degree by early settlers, then devastated for much needed fuel and structural material for mining and ranching in the last century. The lands were overgrazed for centuries by domestic livestock, altered drastically for conversion of woodlands to rangelands, then left alone as an unimportant resource. Finally, there is an awakening that these woodlands are a valuable resource and that they should be managed in that light.

ECOLOGICAL RELATIONS BASIC TO MANAGEMENT STRATEGIES

Managers of pinyon-juniper woodlands need to know about such ecological factors as climate-soil-vegetation relations, water relations, or rooting characteristics and nutrient cycling. This knowledge is vital for intelligent management of these lands as a multiple-use resource.

Climate-Soil-Vegetation Relations

Climate, as noted previously, has the most profound effect on the distribution, productivity, and botanical composition of the woodlands. There are three major divisions of climate in the pinyon-juniper woodlands. First, there are two regimes of overall or "macroclimate": (1) the Southwest, Arizona, and New Mexico, and (2) the mountainous West of Nevada, Utah, and Colorado. The Southwest climate is characterized as warm arid or semiarid, while the mountainous West has a cold semiarid climate. The major climatic factor that limits growth and distribution and affects botanical composition and productivity of southwestern pinyon-juniper woodlands is low precipitation while in the mountainous West both freezing temperatures and low precipitation are important.

The local climate or "mesoclimate" of both areas is affected by latitude, longitude, altitude, and aspect (different facing slopes) of the topography. The smallest division of climate is called "microclimate" and is characterized by the regimes of water, temperature, and light that affect individual germinating seeds, seedlings, and plants. Microclimate will be discussed fully in the subsection "Regeneration of Vegetation."

Macroclimates and mesoclimates cannot be altered by management, but because they do profoundly affect the distribution and nature of pinyon-juniper woodlands, a knowledge of their effects on the woodlands is essential for planning and management. In developing a woodland resource management plan, delineation of the sites based on productivity is essential. For instance, highest production sites of fuelwood in the Great Basin are at mid to high elevations on north-facing slopes in the southern part of the area and on south-facing slopes in the north. These sites produce the most because they have the highest effective precipitation and most favorable temperature. Areas to be converted to grassland for livestock production would preferably not be chosen where high productivity of trees is possible and where fuelwood harvest is a viable use in the immediate area. Ideally, a multiple-use land management plan could be established in such areas where tree harvesting on a sustained basis could create conditions for greater forage production for livestock and wildlife.

The influence of mesoclimatic differences as affected by topographic features is seen in botanical composition differences in the pinyon-juniper woodlands. These woodlands occupy all topographic positions in the mountain foothills of both the Southwest and the Great Basin. The pinyons tend to be dominant at higher elevations than junipers, but are often subdominant in other situations. This pattern probably reflects the xeric nature of juniper compared to the more mesic pinyon. The Colorado pinyon-alligator juniper habitat type requires more mesic conditions than does the Colorado pinyon-oneseed juniper type. Alligator juniper does not become an important component of the woodland until elevation reaches 6,750 ft. Apparently, shifting competitive relations are responsible for these differences as the mesoclimate changes with different elevations.

Understory species in the woodland seem to be even more sensitive to topographic variables than are the tree species. For example, in central New Mexico two shrubby species, walkingstick cholla and skunkbush sumac, exhibit opposite responses to topography. Cholla densities are highest on nearly level south-facing slopes. Skunkbush has greatest density and cover on steep north-facing exposures. Wavyleaf oak, another abundant shrub in the area, has greatest canopy cover on steep slopes, but its cover is not greatly influenced by different aspects.

Although soils are diverse in these woodlands, they play a secondary role to climate in the distribution and nature of the woodlands. In instances where the soils are shallow and rocky or have an impermeable pan or horizon in their profile or a vesicular crust on their surface, their water-absorbing and water-holding capacities are low, thus reducing available water to plants. Where deep, highly organic, friable soils are found, effectiveness of precipitation is increased in terms of water available for plant growth. Soils influence vegetation by altering regimes of available water.

Productivity of soils is related to their fertility level in addition to soil depth, texture, and structure. Soils with relatively high nitrogen levels with adequate phosphorus, sulfur, and other nutrients will be best for production of trees, shrubs, and herbaceous vegetation. The fertility level of soils is dependent on parent material and past and present vegetation on the site. It can be altered by management practices such as burning or tree harvesting.

Unfortunately, detailed information on soils and soil-vegetation relations is not currently available for the pinyon-juniper woodlands. For now, management decisions must be made in relation to soil in a general way only. In the future, information concerning detailed soil-vegetation relations will perhaps be available to management personnel, at least for specific areas.

Water Relations Among Species

Water relations among species are important in determining botanical composition of the pinyon-juniper woodlands and in the selection of revegetation species. The availability of water is the most important limiting factor affecting survival and growth of plants in both arid and semiarid environments. Frequent drought conditions in these areas dramatically impact vegetation responses and land management decisions such as grazing strategies and range improvement.

Morphological adaptations and those based on physiological mechanisms are important to plant drought tolerance. Some of the more important morphological adaptations are deep or widespreading root systems, common in species of pinyon and juniper; sunken or small stomata, characteristic of most conifers (in juniper, stomates are under the scales); small leaf size and reduced numbers of leaves; cuticle formation in the leaf epidermis; presence of water storage tissues, most common in cactus; and leaf folding, rolling, or changes in leaf angle in response to water stress.

Physiological adaptations for drought tolerance include: stomatal control of water loss during periods of stress; alternative photosynthetic pathways, most common example in rangeland plants being the C_4 photosynthetic pathway thought to confer some drought-tolerance capabilities over the more prevalent C_3 pathway; and osmotic adjustment or the lowering of protoplasmic osmotic potential resulting from a net accumulation of solutes in response to water deficits. Osmotic adjustment has been recognized as a significant adaptation to water stress in some native and introduced range plants. Bluebunch wheatgrass, standard crested wheatgrass, western wheatgrass, and blue grama with numerous halophytes are believed to adjust osmotically to water stress, but the ranges of adjustment or details of their functional responses are not yet well defined.

The use of the basic principles of ecophysiology and water relations among plant species will refine our knowledge about species adaptability in managing and revegetating the pinyon-juniper woodlands. By understanding drought-tolerance adaptations, the selection of revegetation species and the breeding of new strains could result in more successful stand establishment and persistence.

In relation to elevation, moisture is probably the important factor controlling pinyon and juniper distribution. Recent study results indicate that pinyon distribution is limited by its physiological tolerance for water stress at lower elevation, more xeric sites. Pinyon is severely disadvantaged on hotter, drier sites. Juniper is more drought resistant than pinyon, photosynthesizing at much lower leaf water potentials, exhibiting lower leaf water potentials in the field, and maintaining a high leaf carbon gain under xeric conditions.

In a study in northeastern Arizona on a pinyon-juniper site and an adjacent one supporting grass and shrubs, mean site water potentials were significantly lower in the shrub-steppe community than in the pinyon-juniper woodlands. However, few abiotic differences were found between the two sites. There was a slight difference in elevation. Vertical structure of the communities was considerably different, which may lead to decreased wind velocity and less evapotranspiration. The difference in vegetation cover may also account for differing rates of water loss among soil horizons.

A study in Nevada gives us clues on why pinyon invades adjacent sagebrush communities. Research found that encroachment of singleleaf pinyon into adjacent communities may be related to the tree's ability to maintain a more seasonally stable xylem water potential and thereby to endure drought better than the associated shrub plants. Pinyon seedlings require a nurse plant to survive. Nurse plants provide shade and moderate microclimatic stress for young seedlings, but they also compete with seedlings for available water and nutrients.

Another aspect of water relations important to managers is how trees in the woodland use water and change the environment. As western juniper woodlands increase, water resources may deteriorate through an increase in sediments, a decrease in subsurface flow, an increase in interception of precipitation, and a reduction of soil water reserves through transpiration. These in turn lead to a decline in shrub, herb, and grass production. Where juniper trees have been removed, there has been an increase in understory production from 50 to 300 percent.

Rooting Characteristics of Plants

Rooting depth and pattern vary widely among plants of different life forms. In a pinyon-juniper woodland in northern New Mexico, roots of perennial forbs and grasses occur mainly within the first 12 inches of the soil surface. Roots of overstory trees were traced to depths of 20 ft along fractures in the rocks. Root systems of shrubs were the most varied, some with distinct and deep taproots to 6 to 8 ft and others with a more extensive root system in the surface layers of the soil.

Nature and depth of root systems of plants are important factors in water relations among plants. Those plants with deep extensive root systems are able to occupy and extract available water from more of the soil volume, an attribute that becomes more important as the dry season progresses in pinyon-juniper woodlands.

Nutrient Cycling

Trees in the pinyon-juniper woodlands accumulate nutrients beneath their canopies as do other arid and semiarid trees and shrubs. Pinyons and junipers extend their lateral roots into open areas between the tree canopies and extract water and nutrients from this soil. By this process, the

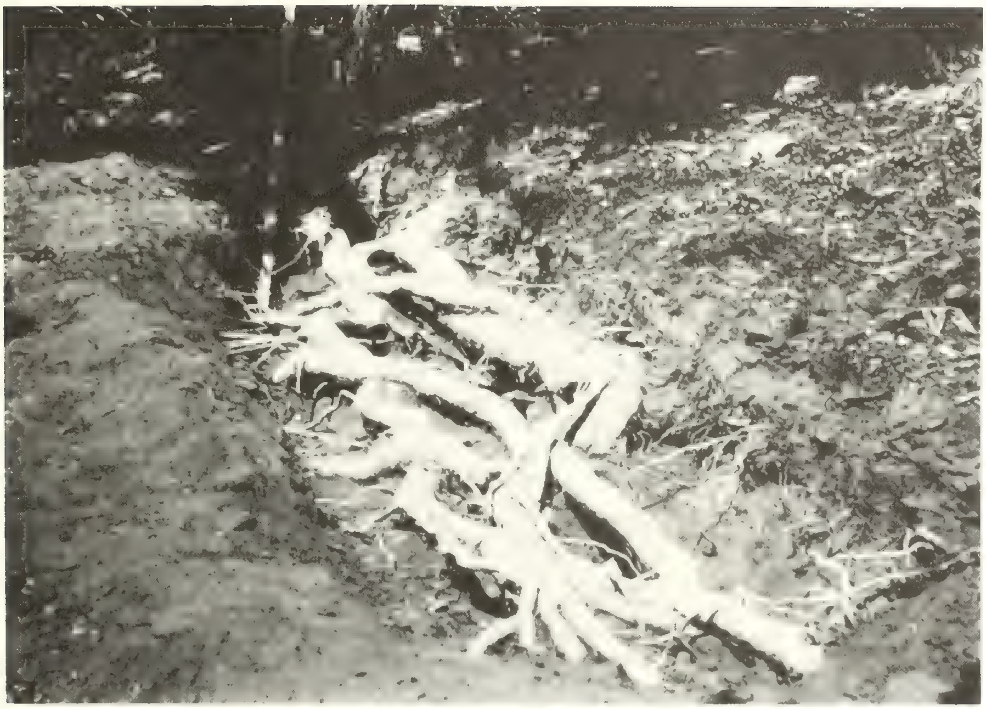

Figure 4—Extensive lateral root system of pinyons makes the trees formidable competitors. The root system mines the interspace areas of available soil water and nutrients and prevents the growth of understory vegetation. (Photo by R. L. Everett, Intermountain Research Station, Forest Service, U.S. Department of Agriculture, Reno, NV.)

available nutrients are accumulated in the branches and leaves of the trees and are released as litter fall beneath the canopies, thus enriching the beneath-canopy areas and mining or taking from the intercanopy areas (fig. 4).

Invasion of trees into adjacent shrub-grass communities may result in substantial shifts in the distribution of nutrients between living plants and the soil-litter-duff system. This results from the extraction and accumulation of greater amounts of nutrients by trees than by shrubs, grasses, or forbs because the trees have greater biomass and more extensive root systems than these other species.

Chaining followed by piling and burning causes a substantial redistribution and loss of nutrients from pinyon-juniper woodlands. Harvesting fuelwood could also cause large losses of nutrients depending on the type of residue treatment. Elimination of all slash and litter by burning could cause a loss of approximately 13 percent of the total nitrogen in the plant-soil system. In an already nutrient-impoverished ecosystem, a loss of nitrogen of this magnitude could likely result in lower biomass production and might lead to successional changes resulting in invasion and domination of annual weedy species.

Regeneration of Vegetation

Regeneration of pinyon and juniper and their understory depends on condition of the microsite, the presence of nurse plants, chemical reactions of plants to each other and competition among plants. This section gives two examples of succession in the woodlands following disturbance by fire.

PINYON PINE

Good seed production of pinyon pines occurs on trees that are 75 to 100 years old. Maximum seed production probably occurs on older trees (160 to 200 years old). Two-leaf pinyon begins to bear cones at about 25 years while singleleaf pinyon does not produce cones until 35 years. Cones require three growing seasons to mature. Pinyon pines are generally monoecious; that is, they bear both male and female flowers on the same tree. As in other pines, the flowers are wind pollinated. Pinyon seeds are heavy and wingless and are not adapted to wind dispersal. Birds and rodents are probably the main dispersal agents. The relationship between feeding habits of birds and small animals and seed dispersal and germination in pinyon and juniper is an important link in the establishment and maintenance of the woodlands.

Four species of birds are known to eat and cache pinyon seeds. ("Caching" is burying the seeds singly or in clusters in the soil, usually about 1 inch deep, and later coming back to recover at least some of the seeds.) The bird species are Clark's nutcracker, pinyon jay, scrub jay, and Steller's jay. Coadaptation of Clark's nutcracker and pinyon jay with two-leaf pinyon occurs in the Southwest. In good seed years, a flock of 150 Steller's jays can transport 3.3 to 5 million seeds a distance of 13 miles. Pinyon jays, a somewhat smaller bird, can transport 30,000 seeds per day up to 6 miles. The seeds can be cached in the soil (one seed per cache) in openings, under trees or shrubs, or along edges of tree trunks, rocks, or stumps, depending on the species of bird. Some are even cached in crevices on live tree trunks or in rock or stump crevices.

The noted ecologist and conservation philosopher Aldo Leopold once wrote that to remove pinyon jays from the pinyon-juniper woodlands of the Southwest would result in the death of that community. The relationship of the pinyon jay to pinyon pines is so strongly interwoven that it represents one of the best coevolved, mutualistic plant-vertebrate examples known. The trees benefit by the birds caching their seeds, in desirable germination sites, and the jays benefit from a food high in energy and nutrients.

Pinyon seeds germinate in the spring following snow melt. The fresh seeds have high viability varying between 85 and 95 percent. However, seed viability decreases rapidly in 1 year or less, and the rate of germination is slow. Also, germination is best with moderate temperatures (65 to 75 °F).

Although pinyon pines are intolerant to shade, most seedlings establish under the canopies of trees or shrubs because usually the overstory vegetation is not dense enough to reduce light to a critical level. Favorable conditions of available soil water and moderate temperatures, because of shading of adjacent plants, are vital environmental factors to seed germination and seedling establishment in pinyon.

Singleleaf pinyon seedlings can develop a taproot 6 inches long in 10 days, and seedlings can withstand soil water below the wilting point for about 2 weeks. However, in the field severe drought is common for long periods so seedlings only survive in the most favorable microenvironments.

Shoot growth is extremely slow during the seedling stage and in early years. Shoot growth in singleleaf pinyon is less than 1 inch per year. Because of their slow growth and susceptibility to adverse microenvironmental conditions, pinyon seedlings cannot tolerate competition from grasses and other herbaceous vegetation. Further, young trees are susceptible to fire. Seedling growth is highly dependent on soil nutrient status and is increased by local enrichment under shrubs and trees.

Junipers, which have a broader ecological amplitude in terms of temperature and moisture than does pinyon, seem to invade an area first and are subsequently replaced by pinyon as the community dominant, at least in the more mesic and more favorable areas.

In the Intermountain area, fire is the main natural disturbance in the woodlands. A proposed sere or chain of successional stages suggests that, immediately after fire, annuals invade and dominate. Then shrubs and perennial grasses dominate and are replaced by pinyon and juniper trees. Tree seedlings appear about 30 years after a fire and generally dominate the site in 70 to 80 years.

Many sites rapidly return to woodland after chaining or cabling. This is not from seedling establishment but rather from small trees or whips that are not killed in the rehabilitation process. Sprouting alligator juniper is also common in bulldozed areas.

JUNIPER

Oneseed juniper trees produce seeds when 10 to 20 years old. The fruit is a berry that ripens in August or September the first year after flowering. Large seed crops occur every 2 to 5 years. The seed coat consists of an outer fleshy layer of pectic substances, a thick lignified stony layer, and a thin inner membrane of suberized material. In several junipers the hard seed coat interferes with water uptake. Germination is delayed by embryo dormancy and by impermeable seed coats, immature embryos, or germination inhibitors.

Juniper seed germination is extremely slow. Under laboratory conditions, untreated seeds reached 50 percent germination after 40 days of incubation. When seeds were leached in water for 48 hours, germination reached 85 percent after 40 days. When leached seeds were cold-stratified for 90 days, germination was about 90 percent. The additive effects of these various seed treatments show that seed germination in juniper is not a straightforward process, but one that requires a specific sequence of environmental conditions for successful natural germination and seedling establishment.

In addition, seeding failure is often due to nitrogen and phosphorus deficiencies in the soil. Studies have shown that certain levels of available phosphorus are particularly important for seeding success.

Seed dispersal is mainly by birds or small animals. Rows of juniper seedlings can be seen along fences where birds perch. Apparently, birds ingest juniper berries, and seeds that go through their digestive tract germinate and seedlings become established. Rodent caching of juniper berries is also an important means of local dispersal.

In north-central Arizona, thousands of robins appear at water sources near juniper berry crops, and each bird consumes over 200 berries per day. These birds fly up to 6 miles to roost each evening. Defecation of undigested seeds is common during these long flights. In this way, robins play a major role in recruitment of young trees in the woodlands and in the invasion of trees into surrounding communities.

In Oregon, establishment of western juniper in the field mainly occurs beneath canopies of sagebrush or established junipers. Apparently, woody plants act as nurse plants for juniper seedlings, reducing soil surface temperatures by shading and by providing more favorable growing conditions in relation to available soil water and nutrients. Juniper seedlings may have an advantage over adjacent shrubs because of more stable water potentials thus allowing the invasion of junipers into shrub and grass communities.

UNDERSTORY SPECIES

Antelope bitterbrush is one of the most important shrubs in the pinyon-juniper woodlands. Its seed and seedbed ecology portrays another important example of plant-vertebrate mutualism. Many species of rodents cache and eat the highly nutritious seeds of bitterbrush. Some cached seeds are overlooked when the rodents are retrieving and eating their hoards. These cached seeds are buried to a depth in the soil that creates a favorable microenvironment for seed germination and seedling establishment. General observations and results of specific studies indicate that rodent caching is one of the factors, or possibly the most important factor, in natural regeneration of these shrubs.

MICROSITE CONCEPT IN RELATION TO PLANT ESTABLISHMENT

To better understand relationships between plant establishment and favorable environmental conditions, let us explore the concept of the safe microsite. A safe microsite is a point in the soil or on its surface where environmental conditions are favorable for seed germination and plant establishment and growth at a specific time. Safe microsites modify the environment in their immediate vicinity to permit germination and establishment. A rough microtopography of the soil surface, a soil surface covered with plant litter and duff, and the shading by plants, a rock, or a twig all create more favorable microenvironments conducive to plant establishment. Seed burial is also important in creating favorable conditions.

The number of plants established is more a result of the number of safe sites, or sites that have a microenvironment capable of supporting germination and seedling establishment, than the number of seeds that are disseminated.

Available water for germination and growth is paramount in the pinyon-juniper woodlands as it is in other communities in arid or semiarid environments. Favorable temperature regimes that allow plant processes to occur and influence moisture conditions of plants are secondary in importance. In certain instances, light intensity and quality are also important in defining a safe microsite. Intensity and duration of wind can be contributing factors. Also a factor is the genetic capability of plants to germinate and establish in relation to the safe sites.

Soil water available for longer periods and temperatures within regimes favorable for germination result from modifications of the microenvironment permitting natural establishment of plants. These modifications and their beneficial effects should also guide any revegetation attempt. After all, a seed that falls or is placed on a bare soil surface will not germinate unless it has special adaptations for such an environment. Seeds of weeds such as Russian thistle or tumblemustard are among the few that possess such adaptations. Seeds buried in the soil, placed in a furrow or depression, covered with litter, or shaded in some way have an infinitely better chance to germinate and establish a plant.

PLANT COMPETITION

Deleterious modifications of the microenvironment can delay or deter plant establishment. These are caused by plant competition and allelopathy. Plant competition may manifest itself by limiting available soil water to a germinating seed or growing plant, or by shading an emerging seedling so it does not get enough light to survive.

In the pinyon-juniper woodlands, available soil water is usually the environmental factor limiting plant establishment and growth. Therefore, available moisture is logically the most important factor in competition among plants.

Some plants compete more effectively than others. Some plants that we classify as weeds in pinyon-juniper woodlands are aggressive alien annuals that by virtue of their rapid seed germination and rapid and prolific growth can extract available soil water quickly and thus deter establishment and growth of other plant species. In the Intermountain area, cheatgrass is among the most adapted alien annuals and is prevalent especially in the early stages of fire succession or following other disturbances when shrubs, trees, and perennial grasses are destroyed.

In areas of western juniper, the alien annual grasses, cheatgrass and wildrye medusahead, dominate after fire or after tree control or harvest. These grasses respond dramatically to the nutrient release, especially available nitrogen, and negate any revegetation attempt using perennial grasses or other forage and browse species without using adequate weed control.

NURSE PLANTS

The value of nurse plants in establishment of pinyons and junipers is critical. The role of shrubs and large trees in aiding seedling establishment is one of creating a safe microsite for seed germination and seedling growth: (1) by shading the immediate area, which lowers temperatures and prevents rapid loss of available water in the soil, and (2) through the accumulation of litter beneath canopies, which improves moisture and temperature relations, provides nutrients to the developing seedlings, and makes the surface soil more friable.

The adverse effects of competition from mature shrubs and trees through shading and reducing available water in the soil profile seemingly are more than offset by the benefits of the altered microenvironment. In many instances, the competitive effects are not a significant factor in this relationship, and the benefits of the nurse plants are manifested in establishment and growth of young pinyon and juniper trees.

ALLELOPATHY

Allelopathy, the chemical inhibition of one plant by another, is one means of restricting establishment of potential competitors. Leachates from juniper and pinyon foliage inhibit germination of associated understory species. Foliage of singleleaf pinyon contains essential oils having allelopathic effects. Field and greenhouse studies indicate that seedling emergence was reduced from seeds buried in the fermentation layer of pinyon and juniper litter. Emergence was not reduced when seeds were buried in the mineral soil beneath the litter layer, and the allelopathic effect of litter affected some species but not others.

Allelopathy plays an interactive role with other environmental factors in creating understory spatial patterns associated with woodland succession. Allelopathy prevents establishment of understory species rather than eliminating established plants, and its effects are probably secondary to drought stress.

When drill seeding in pinyon-juniper woodlands, the seeds must be placed below the litter layer into the mineral soil for successful plant establishment. When seeds are broadcast, species must be selected for their ability to establish in tree litter. Examples of such species are standard crested wheatgrass, alfalfa, and blue flax.

SUCCESSION IN PINYON-JUNIPER WOODLANDS

Succession is the natural replacement of one community by another. In ecological thought in the United States, the direction of succession is considered to be toward climax or a community that can best use environmental factors in a specific climate. Such factors as different soils and their potential to support different plant species complicate succession and the climax vegetation. In pinyon-juniper woodlands, successive stages of vegetation usually contain the same species but in different amounts and dominance of the landscape.

We have previously discussed factors that affect succession and stage of succession in pinyon-juniper woodlands, including past history, disturbance such as wildfires, pattern of use of the woodlands, and different soils and climatic regimes. The driving force of succession is competition among plant species of different genetically controlled capabilities responding to changes of the environment.

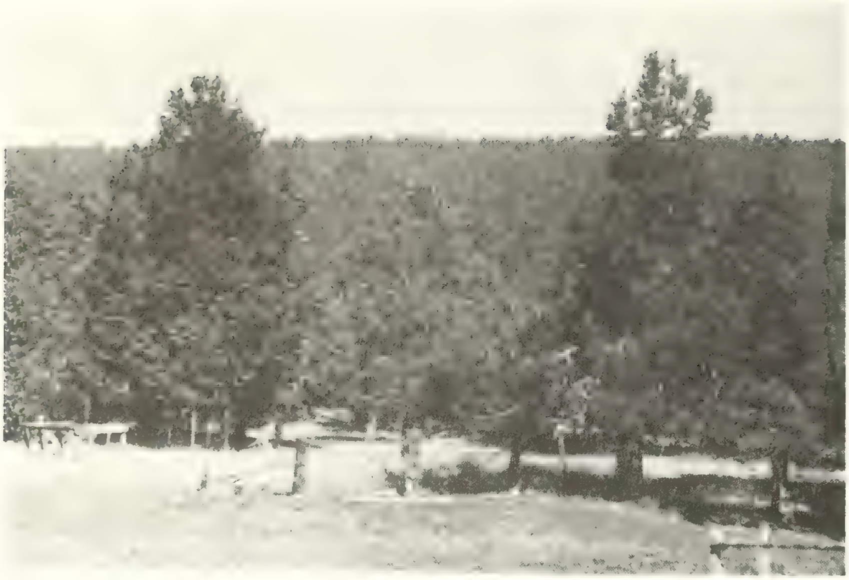

Figure 5—In this dense even-aged stand of western juniper in northeastern California, the almost complete tree dominance excludes all understory vegetation, thus creating unsuitable rangeland for domestic livestock and undesirable wildlife habitat. (Photo by J. A. Young, Agricultural Research Service, U.S. Department of Agriculture, Reno, NV.)

Two sequences of secondary succession after fire will serve as examples of succession after disturbance. One is for southwestern Colorado and the other for western Utah.

FIRE SUCCESSION IN SOUTHWESTERN COLORADO

Climax pinyon-juniper forest
↓
Fire
↓
Skeleton forest and bare soil
↓
Annual stage
↓
Perennial grass/forb stage
↓
Shrub stage
↓
Shrub/open tree stage
↓
Climax pinyon-juniper forest

FIRE SUCCESSION IN WESTERN UTAH

Juniper woodland
↓
Fire
↓
Skeleton forest (dead trees) and bare soil
↓
Annual stage
↓
Perennial grass/forb stage
↓
Perennial grass/forb/shrub stage
↓
Perennial grass/forb/shrub/young juniper stage
↓
Shrub/juniper stage
↓
Juniper woodland

In the example for western Utah, the annual stage could be bypassed to some degree on areas having fair perennial herbaceous cover prior to burning.

There are important justifications for a better understanding of succession in managed and unmanaged pinyon-juniper woodlands. The combination of successional stages or states determines how many products can be obtained from the woodlands and how many values they represent. Multiple use is inconceivable without a combination of successional states.

The managers' challenge is to attain a mosaic of successional levels producing the desired vegetation diversity for an appropriate combination of uses. An unbroken tract of dense woodland produces little besides wood products, and an area cleared and seeded to standard crested wheatgrass supplies little besides cattle forage. However, a combination of these two and their edge effects can be a valuable multiuse resource.

Expectations about succession and its various stages are anticipated in all silvicultural and range management prescriptions. When this concept is clearly perceived and acknowledged by writers and users of such plans, the predicted outcome can be realized.

A large portion of the pinyon-woodland type is exhibiting undesirable successional tree superdominance. In many areas, this could lead to increased soil erosion, eradication of understory plants, the threat of large-scale fires, and site degradation (fig. 5).

MANAGEMENT STRATEGIES AND PRODUCTION ALTERNATIVES

The pinyon-juniper woodlands, growing in areas that are more xeric than any other timber type in the United States, have unique silvicultural characteristics. Also, the demand for products other than wood in pinyon-juniper woodlands, particularly forage for livestock and wildlife habitat, may provide many opportunities to practice multiple-use silviculture. Watershed and recreational values also need to be considered by land managers.

Management for Forest Products

Much of the pinyon-juniper woodlands are presently under custodial management, and large areas are likely to remain so for a long time because slopes are too steep or productivity is too low to justify intensive management. However, there are many areas of woodland that can and do produce fuelwood, poles and posts, and pine nuts, and perhaps in the future, other forest products.

To exert the proper control of harvest and growth in these woodlands we need to know:

1. How much do we have?
2. How fast does it grow?
3. How can it be regenerated?
4. How is it to be utilized?
5. How does forest product production relate to other uses?

How do we get answers that we can use for the management of pinyon-juniper woodlands? The three steps to consider are inventory, growth projection, and harvest scheduling through a planning model.

INVENTORY

In recent years, a fairly rapid development of inventory techniques has included LANDSAT satellite data, aerial photos, line intercept transects, and fixed or variable plots with equations developed for woodland segmentation procedures. Despite such technological progress, construction of volume equations for pinyon and juniper trees still presents unique problems.

Unlike most conifers, excessive branching and multiple basal stems appear to be normal growth patterns for pinyons and junipers. A variety of measurements have been tried to ascribe quantitative values to the bushy growth characteristics of these trees, including crown and stem variables in volume equations and conventional variables of trunk diameter and tree height. Recently, volume equations have been formulated for much of the pinyon-juniper woodlands based on measurements of tree diameter at the root collar (DRC), total height, and the number of basal stems. They apply to most of the pinyon and juniper species found in woodlands of many States, in addition to several other tree and shrub species.

Because of the diverse growth forms and the tremendous variability of trees from site to site, these generalized equations give volume prediction errors up to 20 percent, and in specific instances they may be even less reliable. For large-area surveys such as on a State basis, they do provide adequate reliability. Development of local volume equations for each application is perhaps the best means to obtain precise volumes of pinyon-juniper woodlands. This would be fairly simple by subsampling trees from an inventory for volume by visual segmentation. A regression volume equation can then be developed reflecting the diverse tree forms in the specific area.

A comprehensive inventory consists of more than just plot-taking techniques and volume estimates. Meaningful information must be developed that will permit projection of growth and estimation of changes in size or age classes as time passes. At present, Forest Service cover typing differentiates major aspects of pinyon-juniper woodlands, such as juniper woodland, oak woodland, pinyon-juniper, and Rocky Mountain juniper. Size classes used for pinyon and juniper are nonstocked, seedlings and saplings (4 inches tall to 2.9 inches diameter at root collar, DRC), small trees (3.0 to 8.9 inches DRC), and large trees (more than 9.0 inches DRC).

Additional useful information includes accessibility, stocking, and slope classes. Some measure of site quality and potential is desirable because of the broad range in productivity that exists in the pinyon-juniper woodlands. Sites vary in their potential from ones that can support little more than juniper shrubs to those that produce trees more than 30 inches in diameter. Management on such diverse sites will differ greatly.

Results of a study in Arizona, New Mexico, and southern Colorado indicated that tree height-age site index curves were useful in predicting volume when used with stand density. This study also indicated that height-age site indices could be used for developing growth equations for individual tree species in the woodlands.

GROWTH PROJECTION ESTIMATES

Growth projection estimates have used various measurements including basal area at 1 ft above the ground, volume and age, and height and age. Regardless of methodology used, estimates must be made on how various strata in the woodland will change with time. The volume and growth of each stratum provide needed information for a harvesting schedule.

Growth is dramatically affected by site quality and stocking. Productivity ranges from 2 ft^3 to more than 30 ft^3 per acre per year on well-stocked, good sites. A productivity level should be determined at which some sites should be excluded from management for periodic fuelwood cutting and others retained for fuelwood harvesting.

The growth projection should also form the basis for the management regimes and rotational ages that will be used in harvesting schedules. Harvesting schedules also include types of harvesting that are to be done on specific areas.

SILVICULTURAL PRACTICES

Past management emphasis of pinyon-juniper woodlands has primarily been to modify the woodland overstory to increase forage production for livestock grazing. As a result, little is known about the silvical characteristics, proper stocking levels, silvicultural systems, or cutting methods that are best suited for pinyon and juniper regeneration and stand management. But silvicultural techniques do apply and should be implemented in these woodlands. However, no one silvicultural system of harvesting is best for all land management situations, and local conditions and needs should dictate the methods used. The land manager should select the most appropriate silvicultural technique to meet both land management direction and the tree species silvical requirements.

A silvicultural system includes the entire process by which woodland stands are tended, harvested, and replaced. The system includes all cultural practices performed during the life of the stand such as regenerative cutting, fertilizing, thinning, improvement cutting, and using improved seeds and seedlings in a rehabilitation process. Silvicultural systems can be distinguished as either even- or uneven-aged.

Even-Aged Systems—An even-aged silvicultural system results in a stand of trees that are about the same age. By definition, the difference in age of trees will not usually exceed 20 percent of the rotational age. The rotational age can vary from 160 to 240 years depending on the management objectives. The two acceptable cutting methods used in an even-aged system in pinyon-juniper woodlands are clearcut and shelterwood.

The clearcut method, cutting the entire stand, is used when regeneration is relatively certain either naturally or by artificial planting. Natural regeneration in most pinyon and juniper stands is not reliable because of the infrequency of good seed years and years with weather conditions conducive to good germination and seedling establishment. Further, both pinyon and juniper trees have large wingless seeds that deter adequate seed dispersal.

In many instances, however, the success of clearcutting regeneration is markedly increased by leaving some trees, seed dispersal by birds and rodents, leaving slash to moderate the soil surface conditions for better seed germination and seedling growth, and in stands of the sprouting alligator juniper.

With stand clearcutting there is immediate control over the size and shape of the future stand that can be manipulated to meet management objectives, especially to create a shrub-grass-forb seral stage for livestock use and a diverse wildlife habitat. Clearcutting is the simplest method to use, requiring the least amount of silvicultural skill, sale preparation, and administrative time. Important disadvantages are that natural regeneration is not assured and the site is exposed to direct insolation and wind and water erosion.

The shelterwood method is implemented in two or more steps, the seed cut and the removal cuttings, over a period of up to 40 years. The seed cut is when all merchantable trees are removed except the best and the biggest, which are used as sources of seeds for regeneration and to shelter developing seedlings. Later, the removal cut is made when the seed trees are cut to improve growing conditions for the newly established seedlings and saplings by removing the sheltering big trees. The number of seed trees usually left is between 25 and 100 per acre. Site quality and desired regeneration stocking are two factors that will influence seed tree spacing.

An option is also available in the removal or final cut to leave some seed trees for pine nut production if pinyon pine is present in the stand.

The two-step shelterwood cutting method requires more skill than clearcutting and involves higher costs of marking leave seed trees and sales administration. In some instances, the stand will become overstocked before the removal cut is made. Advantages of this cutting method include good control over site conditions for natural regeneration, good site and soil protection, and stand appearance that is esthetically more acceptable than other methods.

Uneven-Aged Systems—Uneven-aged silvicultural systems involve the manipulation of stands to simultaneously maintain continuous high forest cover, recurring regeneration of desirable species, and an orderly growth and development of trees through a range of sizes. Stands that are managed under uneven-aged systems do not have an established management rotation age. Management objectives are met by controlling size and number of trees. There are two regeneration cutting methods that develop and maintain uneven-aged stands: single-tree and group-selection cutting.

With single-tree selection, less desirable trees from specific size classes are periodically removed to regulate and improve stands of trees. This method works well for woodland regeneration and growth but requires a high degree of skill to use.

The group-selection cutting method removes small groups of trees over the entire stand with size of cutting areas held to areas small enough to assure protection from surrounding trees. This cutting method does not work well in pinyon-juniper woodlands because the groups of cut trees are small and difficult to track.

SLASH MANAGEMENT

The methods of slash management are influenced to a high degree by the ecological principles discussed earlier. Prescribed burning clears the area of slash, releases nutrients, and kills weed seeds. It also bares the soil creating a clean seedbed for drilling of seeds of revegetation species. In the burning process, some nitrogen is lost to the atmosphere, depending on the temperature of the fire. However, more nitrogen is made available by the burning process and subsequent nitrification. Other nutrients are released without loss.

Prescribed burning to remove slash could deter natural establishment of plants by baring the soil and creating harsh seedbed conditions on the soil surface. In some instances, an area could be open to increased wind and water erosion. Many of these deleterious results can be avoided by burning under cool, moist conditions in the winter or spring. Under such conditions the fire will burn at lower temperatures and slowly move along the ground consuming most of the accumulated material.

Studies in Nevada indicate that slash left to gradually decay after fuelwood cutting has several advantages. A favorable seedbed is provided for germination and seedling establishment by the accumulated slash on the soil surface. However, in some instances the litter might be too heavy for the seeds to penetrate to the soil surface, so they become perched in the litter exposing them to desiccation. The gradual decay of litter will permit the slow release of nutrients and retard nitrogen loss. Additionally, slash cover of the soil surface provides a degree of erosion protection. An important disadvantage of letting slash accumulations gradually decay after fuelwood harvesting is the temporary fire hazard that this accumulated material presents. However, the degree of flammability from accumulated slash is much reduced after the first year because the needles have dropped from the branches.

Slash removal by burning is easier in areas that have been clearcut. In other harvesting methods, more care is required in prescribed burning, such as piling most of the heavy material and burning the piles individually and broadcast burning the rest of the area under safe conditions so the remaining trees are not harmed.

Management for Forage and Browse Production

Managers need to consider two aspects of production of forage and browse in the pinyon-juniper woodlands. The first is the control of trees and shrubs. The second is the revegetation of shrubs and herbaceous species, including the deterrents for their favorable establishment.

METHODS OF TREE AND SHRUB CONTROL

The principal methods of tree control for increased forage and browse in the pinyon-juniper woodlands are mechanical—chaining, cabling, bulldozing, fuelwood harvesting without regard for regeneration, tree crushing, and variations and combinations of these; fire, either by rehabilitating after wildfires or using prescribed burning; and chemicals—the use of herbicides, either on an individual tree basis or by an areawide application.

Mechanical Control—Since 1950, about 550,000 acres of pinyon-juniper woodlands on the National Forests in the Southwest have been mechanically treated to improve forage production. Over 500,000 acres were chained for tree control by the Bureau of Land Management (BLM) in the Western United States between 1960 and 1972. In addition, many acres of pinyon-juniper woodlands on private property have been converted to grazing land by mechanical means.

Pinyon-juniper woodland conversion work in general has received less and less emphasis in recent years. For example, pinyon-juniper chaining by the BLM peaked at about 80,000 acres per year in 1967, dropped sharply to about 35,000 acres annually in 1968 and 1969, and after that has been steadily declining.

Evaluations of BLM projects in the Intermountain area showed that chaining-windrowing-drilling was the most costly but most effective method of converting pinyon-juniper woodlands to grassland. The least effective and most inefficient method was chaining alone because it released too many young trees.

Because of the inefficiency of chaining and the fact that so many of the woodlands were converted by chaining, today these areas should be re-treated if forage production and the resultant carrying capacity is to be improved. In fact, close to 80,000 acres of the original 550,000 converted acres in the Southwest have already been re-treated, mostly by bulldozer pushing and individual tree treatment of pelleted herbicide, with some prescribed burning and handcutting.

Fuelwood Cutting—Pinyon pine and juniper are preferred fuelwood species and, in accessible areas, their availability is becoming limited. Between 1977 and 1979, fuelwood sales increased 62 percent. The cutting of trees for fuelwood is an excellent method of tree control. In areas where livestock grazing use and wildlife habitat are land management objectives, clearcutting would be an efficient and inexpensive conversion method.

In many instances, recreational or commercial fuelwood harvesting could be combined with woodland conversion. However, in most instances in such a plan, commercial harvesting of fuelwood is not economically feasible if the city markets are more than 100 to 150 miles away. Longer distances could be justified in specific instances in large metropolitan areas where demand is high.

Prescribed Burning—Ease and efficiency of prescribed burning in pinyon-juniper woodlands depends primarily on the number and species of trees present, nature of the understory vegetation, and weather conditions.

Prescribed burning can be effective in closed stands of pinyon and juniper with 300 or more trees per acre in areas of 14 to 18 inches of precipitation if the proper preparations are made. Closed stands of juniper are almost impossible to burn and require winds of more than 35 miles per hour to carry the fire. Burning in closed stands of trees usually requires large crews for preparation or pretreatment, such as chaining or windrowing, and to ensure that the fire will not escape.

In open tree stands with grass understories, fire kills only pinyon and juniper trees less than 4 ft tall. Moreover, it usually requires at least 600 to 700 lb/acre of fine fuel to carry a fire. Prescribed burning could be used to kill young seedlings or saplings in converted grasslands when the grazing management plan calls for a rested pasture.

Prescribed burning to control trees is relatively easy where mixtures of sagebrush and pinyon-juniper occur, a common community in the Intermountain area. This burning can be done in the spring, under prescribed conditions, and in many instances without firelines.

Studies in Nevada suggest that two types of mixed shrub and tree communities are best for burning. One is the scattered community (9 to 23 percent tree cover) where pinyon and juniper start their influence and begin to dominate the understory. The other is the dense tree community (24 to 35 percent) where trees dominate the site to a great extent. These two types of communities can be burned out of fire season under a certain set of conditions.

An analysis of burns in Nevada indicated that the success of a burn could be predicted accurately (89 percent) by adding the maximum windspeed in miles per hour, the air temperature in degrees Fahrenheit, and the percentage of vegetation cover. With a score of 110 the fire would not burn. Scores between 110 and 125 needed continual retorching. Scores between 126 and 130 produced fires that carried by themselves and created clean burns. And above 130, conditions were too hazardous to burn (fig. 6).

Herbicidal Control—Much research has been done on the chemical control of pinyon and juniper trees including evaluations of many herbicides with foliar spraying, broadcast application of pelleted or granular forms, and individual tree treatments with pellets or granules. This research was prompted by the fact that severe ecological consequences accompany many pinyon-juniper control methods, and the use of herbicides would offer alternatives that are less disturbing to the plant communities. Also, the use of herbicides offers possibilities for more efficient re-treatment methods without disturbing grasses or other forage plants.

Pelleted picloram and tebuthiuron are being used to kill individual trees, to maintain chained or bulldozed areas, and to restore recently invaded grasslands in southwestern pinyon-juniper woodlands. Pelleted picloram also has been used for western juniper control in northeastern California. Both herbicides work through the soil and are

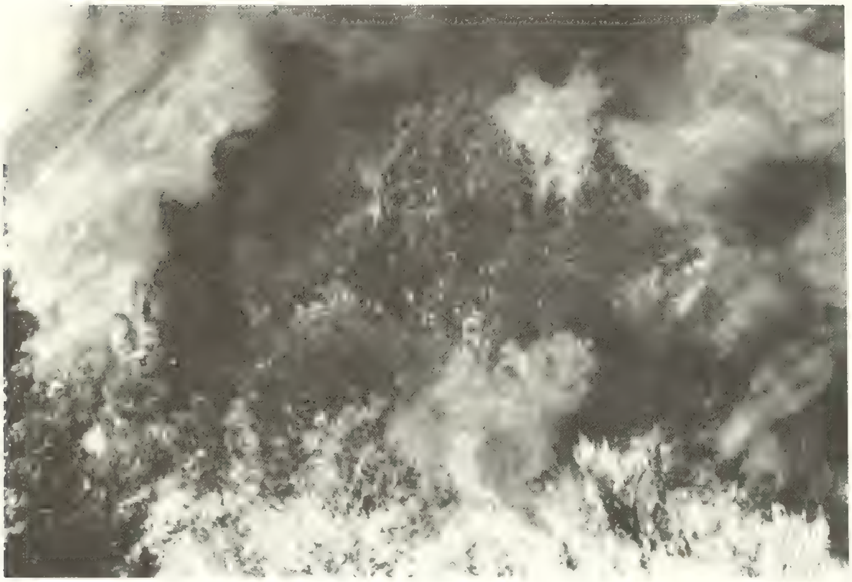

Figure 6—A self-sustaining, out-of-season burn carries through a dense pinyon-juniper woodland in central Nevada. (Photo by R. L. Everett, Intermountain Research Station, Forest Service, U.S. Department of Agriculture, Reno, NV.)

degraded by soil microorganisms and sunlight or growing plants. The hazards to the environment, animals, and people are minimal if label directions are followed.

The most efficient and economical use of herbicides is in controlling saplings or young trees in areas that are being invaded by junipers or pinyons or as a re-treatment after chaining or other land-clearing treatment (fig. 7).

For both herbicides, individual tree treatments are selective because herbicide placement is made directly under the tree. Broadcast applications of either picloram or tebuthiuron will damage or kill susceptible nontarget plants on the treated areas. Established perennial grasses have not been damaged by picloram at recommended rates for tree control. However, similar rates of tebuthiuron can damage cool season grasses.

Picloram is a restricted-use herbicide that may only be sold to certified applicators because of a concern for possible damage to desirable off-site plants, not because of excessive danger to animals or people. Tebuthiuron is a general-use herbicide. Both herbicides are currently registered by the Environmental Protection Agency for controlling junipers and pinyons in Arizona and New Mexico. Picloram is registered for control of junipers in California and Oregon.

Herbicide-use restrictions vary by State, by circuit court case, and by documents prepared under the National Environmental Protection Act. Local restrictions should be checked before chemical control projects are planned.

Where sagebrush and pinyon and juniper trees occur together, the need arises to control the shrubs as well as the trees to lessen competition so that grass and other forage species may establish. This has been done in experimental trials in northeastern California where small junipers were controlled by individual tree application of pelleted picloram and the shrubs by spraying 2,4-D before seeding of grasses and legumes. The recommended rate of 2,4-D (2 lb/acre) was sprayed by ground sprayer to control sagebrush. Because herbicide regulations are constantly changing, check current Environmental Protection Agency registration on chemicals before use.

REVEGETATION OF SHRUBS AND HERBACEOUS SPECIES

In many areas of pinyon-juniper woodlands, the understory vegetation is so depleted because of intense competition from the tree overstory or past overgrazing that any forage restoration project must involve artificial seeding. This step in range improvement involves a far greater risk for success than in areas where there is enough understory vegetation to recover naturally after the overstory trees have been controlled. Many methods have been developed in seedbed preparation and seeding to increase the probability of a successful stand of grass or other forage and browse plants. Improved strains and cultivars of forage species also have been selected or bred to help assure successful stand establishment of a high-producing forage crop.

Safe Microsites for Seedling Establishment—In seeding and seedbed preparation, the ecological principles of the safe microsite underlie any successful method. The seeds must be placed where they will have ample water and favorable temperatures for optimum germination. Then the germinating seedlings need available soil water and favorable temperatures to survive and become established.

Weather conditions in any particular growing season are, of course, the crucial factor in success or failure of a seeding. However, many methods can be used to ameliorate adverse environmental conditions and to better assure seeding success, even in marginal years. On the other hand, some seeding techniques reduce the chances for successful seeding to almost zero in any year. Let us look at some of these seeding techniques and the reasons why they can lead to success or failure.

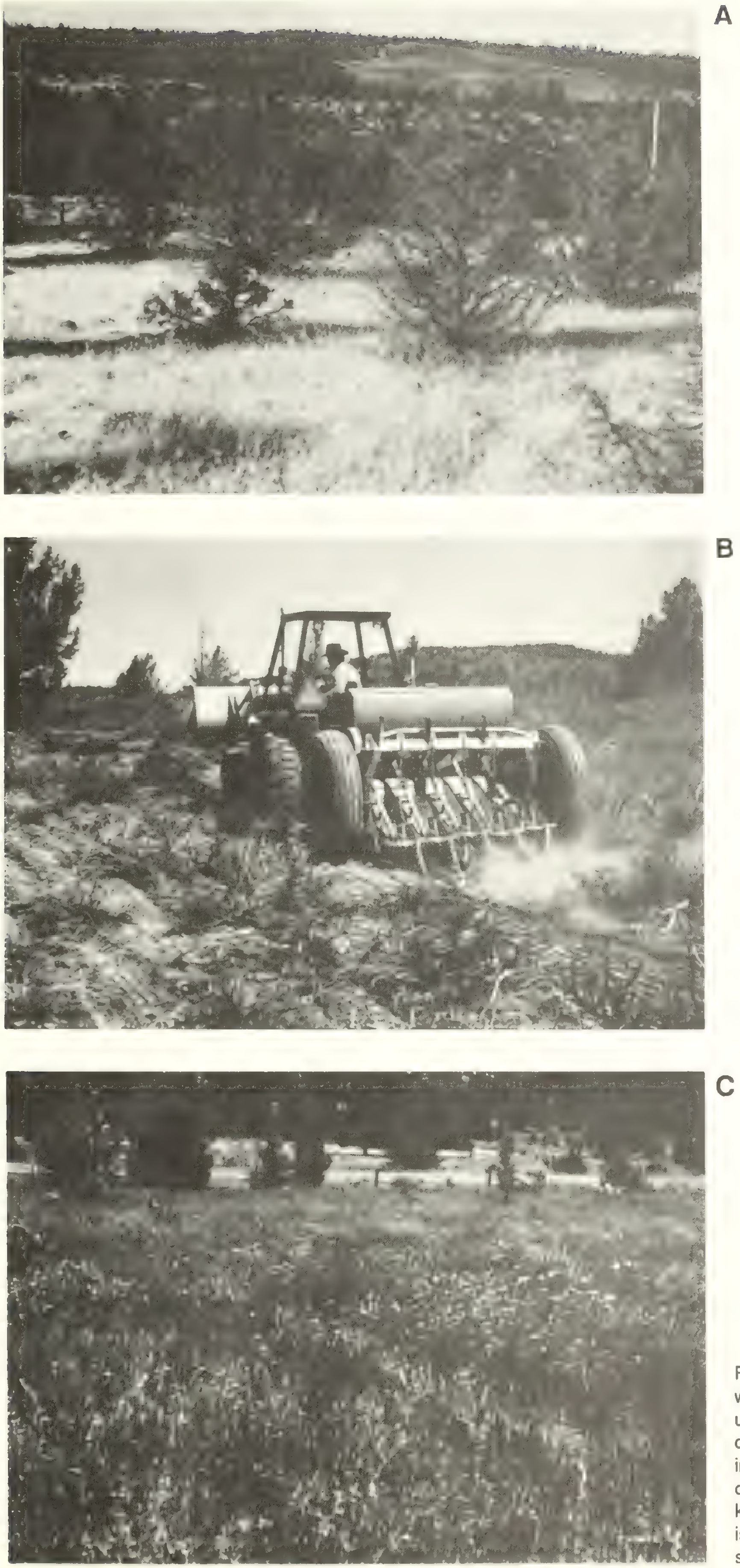

Figure 7—Controlling small junipers (A) and sagebrush with herbicides and directly seeding grass and legumes into the dead shrubs and trees with a rangeland drill (half-size drill is being used in photo B) greatly increases forage for cattle (C). This practice could be classed as preventative maintenance because, by killing small trees in a shrub community, the manager is avoiding a larger problem of tree dominance of the site in the future.

Drilling of Seeds—Covering the seeds in any type of revegetation is essential to prevent desiccation. After a fire or chaining, the most effective seeding is with a rangeland drill. In seeding of the more arid sites, using the modified arms on the rangeland drill to make furrows and to have a wider row spacing is often beneficial. Dragging of juniper or pinyon limbs with the chain after broadcast seeding is an inefficient way to cover the seeds.

The rangeland drill is a seeding implement using a single disk opener that makes a furrow; and the seed is metered from the seed box and drops through a tube immediately behind the single disk. A chain drag covers the seed that has dropped in the furrow. The rangeland drill is massively built, and each arm is independently attached and suspended so it can ride over rocks and stand up to the rigors of seeding on rough rangelands.

Because of its design, the rangeland drill is not a precise seeding implement. The standard practice is to seed two seeds per inch in hopes of getting one plant established per foot. This is an efficiency ratio of 4 percent. Using a relatively inexpensive seed such as standard crested wheatgrass, this practice has been acceptable. When using expensive seed of native perennial grasses or of specific broadleaved herbaceous plants or browse shrubs, the use of the rangeland drill in some instances becomes economically questionable. However, good stands of grasses and other forage species can be established by adhering to proven drilling procedures and seeding with favorable seedbed conditions.

Use of the land imprinter for experimental seeding on rangelands has given seeding successes comparable to the rangeland drill on rangelands in Oregon. The land imprinter appears to be most useful in combination with broadcast seeding on loose or coarse-textured soils. Experimental seeding methods that may improve success of grass seeding are punch planting, planting pregerminated seed, transplanting, and applying water in the seed furrow. Research to modify a precision seeder from New Zealand is also being conducted.

A study of the economics of seeding techniques conducted in pinyon-juniper woodlands after wildfires in central Utah compared aerial seeding and chaining, drilling with the rangeland drill, and land imprinting. Results indicated that drilling and land imprinting were the only revegetation techniques that could be economically justified based on the increase in livestock grazing values. Any other reseeding would have to be justified on the basis of resource protection or other noncommodity values because of the low rate of success.

Broadcast Seeding—Broadcast seeding usually results in the scattering of seeds on the soil surface where they have little or no chance to germinate. In rare instances, aerial seeding has been successful after a fire because the seed was broadcast almost immediately after the burn into a heavy ash layer. The ash layer gave enough protection for the seed to permit germination and seedling establishment.

With aerial seeding, the chances for success in seeding are drastically reduced when compared with drilling. Many sites in the pinyon-juniper woodlands are in terrain with slopes too steep, too rocky, or inaccessible to ground equipment, even with a track-laying tractor. When faced with these situations, land managers should consider carefully the value of revegetating the site and the physical aspects of the seedbed, especially the amount of ash on the soil surface. Broadcasting seeds on bare, steep slopes is futile. Seeding will be a failure.

Broadcast seeding into unburned slash after tree harvest will at times result in success. However, many variables in this type of operation can lead to failure. First, the seeds have to filter through the slash and litter to the soil surface to have a chance for germination and seedling establishment. Then, where cheatgrass and other annual weeds occur, competition from these plants will deter establishment and growth of the slower growing perennial forage species.

Cheatgrass Competition—In the Intermountain area, cheatgrass, an alien annual grass, has invaded many pinyon-juniper woodlands, and when the tree and shrub overstory is removed, this aggressive grass can virtually dominate the site precluding all attempts to establish perennial grasses and other forage plants without weed control. After a hot fire in the pinyon-juniper woodlands, enough of the seed reserve of cheatgrass, which is mostly located in the litter or on the soil surface, is destroyed. An effective fire in the first year provides a brief time window for successful seeding without cheatgrass competition to suppress establishment and growth of replacement species. Seeding at this time also provides an opportunity to take advantage of (1) a quick release of nutrients, even though some nitrogen is volatilized, for good seedling growth, (2) a virtual elimination of all competing vegetation, and (3) a clean seedbed to operate rangeland drills.

Without a hot burn to destroy cheatgrass seeds, the best way to control this weedy grass in preparation for seeding is by disking immediately followed by drilling. This is best done after emergence and some growth of cheatgrass, in early spring or early fall. The soil should be moist at time of seeding with a good probability of subsequent rains and favorable temperatures for optimum seed germination and seedling growth of the planted species.

Herbaceous Revegetation Species—The use of many of the presently available herbaceous revegetation species, varieties, and cultivars will lead to successful stands with adequate seedbed preparation and proper seeding techniques (fig. 8). In addition, new cultivars have been selected for improved seedling vigor and forage production and to control erosion more effectively. Many of these have been field tested and information gathered on adaptation and performance in the pinyon-juniper woodlands. (A complete list can be found in appendix 6.)

Shrub Seeding and Transplanting—Pinyon-juniper woodlands normally support a diverse understory of shrubs and herbaceous species. The shrub component is important, especially for big game habitat, and should not be overlooked in any conversion or revegetation effort. Mixed seedings of shrubs and herbaceous species are better able to control tree establishment than shrubs planted alone. Conversion of pinyon-juniper woodlands has thus been dependent on the codevelopment of shrub and herbaceous species revegetation methodology.

Figure 8—Cattle grazing is an important use of the western juniper woodlands in northern California and Oregon. This area was cleared and seeded to intermediate wheatgrass. (Photo by J. A. Young, Agricultural Research Service, U.S. Department Agriculture, Reno, NV.)

Deterrents for Shrub Establishment—Such deterrents in degraded pinyon-juniper woodlands include (1) problems with plant establishment, (2) site differences and shrub adaptability, (3) competition of weedy annuals, (4) limited access for revegetation because of steep and irregular sites, (5) inadequate planting equipment, (6) seed quality problems, and (7) animal depredation of planted seeds and emerging seedlings.

Poor and erratic seedling establishment is the primary problem that limits shrub use. In high-value and critical areas for deer habitat, transplanting has been done to better assure stand establishment.

Rodent foraging of planted seeds and eating of established plants can decimate large seedings. Rodents and insects prefer seeds of certain species over others. Shrub species most eagerly sought by rodents include antelope bitterbrush, Saskatoon serviceberry, black chokecherry, and bitter cherry. Seeds of species not eaten by rodents are fourwing saltbush, winterfat, sagebrush, and rabbitbrush.

With antelope bitterbrush, a high-value browse species for deer and cattle, there are many inherent problems that are not encountered in establishing perennial grass. Bitterbrush seed has a cold-moist stratification requirement to break dormancy, water requirements for germination are much more exacting than for perennial grasses, and depredation of the planted seed and established seedlings by rodents is a constant threat.

Bitterbrush establishment from planted seeds requires optimum seedbed preparation including good weed control and precisely controlled seeding conditions. Researchers in Nevada have found that early spring seeding, compared to fall seeding, following a hot fire the previous summer, decreases rodent depredation because it shortens the time between planting and seedling emergence, permits adequate time and promotes favorable conditions to break dormancy, and provides favorable soil water conditions for germination and seedling establishment. Seeding success depends heavily on having average or better than average spring rainfall, and even in these years stand establishment is low but adequate for shrub dominance of a site.

When planting bitterbrush or other shrubs with grass, each should be planted in separate rows or spots to reduce the effects of grass competition on the shrub seedlings. Grass plants grow faster and outcompete shrubs grown in mixtures. Naturally occurring understory herbaceous species influence shrub planting success and natural recovery. The invasion of cheatgrass has reduced shrub seedling survival on many sites in the pinyon-juniper woodlands. As was mentioned before, cheatgrass is an aggressive alien annual possessing strong competitive abilities because of rapid germination and prolific seedling growth, especially when compared with slow-growing shrub seedlings.

Planting equipment and methods are currently inadequate to seed shrubs properly. Consequently, these seeding practices do not reflect the full potential of shrub seedings. The rangeland drill and other implements were designed to seed grasses. Most of the equipment cannot be regulated to control planting depths and seeding rates of most shrubs. Tree control and seeding methods have been limited to a few practices, primarily chaining, burning, and broadcast seeding. These practices favor the shrub species that can be reliably established with minimal site preparation.

Progress in Shrub Development—A number of shrub selections have been made and cultivars developed as forage plants for livestock and big game habitat. Numerous other shrubs demonstrate potential for revegetation in pinyon-juniper woodlands, but most have demonstrated weaknesses in seed germination, seedling establishment, or overall growth.

Ecotypes of basin big, Wyoming big, and mountain big sagebrush with higher palatability and increased protein levels have been selected for the pinyon-juniper environment. Also many collections of antelope bitterbrush exhibit specific characteristics that make them well adapted to specific sites. Many other shrub species, some found naturally in the woodlands and others from closely related communities, show much promise for revegetation. (A complete list can be found in appendix 6.)

Grazing Management—For livestock grazing in pinyon-juniper woodlands, grazing management is based on the same principles that underlie grazing systems used on all arid and semiarid rangelands of the Western United States. The categories of livestock grazing systems include: continuous, year-long grazing; seasonal grazing; deferred grazing; rotational grazing; and rest-rotational grazing.

As mentioned, continuous, year-long grazing has been and is the most prevalent system for livestock management in the pinyon-juniper woodlands. The main reasons for this type of grazing are that most of these woodlands have been under extensive management and such grazing has provided low-cost forage for livestock operators. Continuous grazing results in undesirable successional changes in rangeland forage. In the pinyon-juniper woodlands, there is ample evidence of disastrous effects of this type of grazing. Now with greater interest in the management of the pinyon-juniper woodlands, opportunities can present themselves for more intensive management including more suitable grazing systems.

Although differing in detail, more intensive grazing management systems have two features in common: a period of rest to allow forage plants to grow undisturbed, and a systematic grazing schedule in different parts of the range. The objectives of these grazing systems are to (1) restore vigor of forage and browse plants, (2) allow plants to produce seed, (3) attain heavier and more uniform utilization, and (4) increase animal production.

In overall planning for management of pinyon-juniper woodlands for more efficient livestock forage and browse production, use of range improvement practices, such as tree control and seeding, should be coupled with intensive grazing systems.

Details of different grazing management systems are given in the sources listed in the "References" section.

Management for Wildlife Values

The role of wildlife habitat is extremely important for pinyon-juniper woodlands. These woodlands afford favorable habitat, including cover and thermal protection, and a dependable food supply for many birds, small animals, deer and other larger animals, and predators.

As we have seen, tree canopies can dominate specific sites and drastically decrease valuable understory vegetation. When understory shrubs and herbaceous vegetation are reduced or eliminated by a heavy tree canopy, habitat and food for deer and other game animals can be restored and increased by tree control and, if necessary, seeding and revegetating the area with desirable shrubs, grasses, and broadleaf herbaceous plants.

In any vegetation management, tree density should be reduced only to specific levels to maintain thermal cover for animals, habitat and food for birds, and an esthetically pleasing area for recreationists. Methods of tree reduction and revegetation have been covered in previous sections. Generally, habitat improvement for livestock grazing and wildlife can and do go hand in hand. Improvement projects can and should be planned not for a single purpose but keeping in mind that the pinyon-juniper woodlands are a renewable natural resource for many uses.

Many so-called wildlife improvement projects in the pinyon-juniper woodlands have resulted in less productive wildlife habitat. What may be beneficial to one class of grazing animals may not necessarily be beneficial to another. First of all, care must be exercised when decisions are made to treat an area. Questions that must be answered when proposing a vegetation manipulation plan to benefit wildlife include: (1) Does the proposed area need additional and improved wildlife values? (2) How much of the area should be treated for optimum benefits for a wildlife species or group of species? (3) When should the area be treated? (4) What methods should be used to obtain desired results and benefits?

As with improvement practices to increase forage and browse for livestock production, specific conditions must be met for successful conversion to a more desired vegetation for deer and other wildlife (fig. 9). In some instances, release of understory shrub and herbaceous species by killing of trees will accomplish the desired results. In other instances, the understory is so depleted that revegetation is necessary.

When seeding forage and browse species the following factors will determine success or failure. The potential productivity of the site, with such factors as soil type and terrain, amount and distribution of precipitation, and potential competition from weedy or undesirable vegetation are paramount in determining what areas to seed. Only species, subspecies, varieties, and selections that are adapted to the site should be planted. Seeding of multispecies seed mixtures is important for wildlife habitat improvement, especially when the area is also to be grazed by livestock. Nutritional quality, quantity, and variety for both livestock and game can be provided and enhanced through mixtures.

Good grazing management of cattle can be used as a tool to enhance big game ranges and to improve wildlife habitat. As a general rule, newly seeded areas should not be grazed for at least 2 years following seeding. Low potential sites and those seeded with slow-developing and slow-growing species may require as many as four seasons of nonuse to develop into productive stands.

Vegetation conversion for deer habitat improvement may be either beneficial or detrimental to other animals and birds. Lagamorphs (cottontails and jackrabbits) generally prefer converted areas because of the increased forage production and quality that results from tree control and revegetation. Results of a study in New Mexico comparing a cabled area with an undisturbed area indicated that lagamorphs preferred the cabled area during spring, summer, and fall because of increased forage and increased cover in debris and slash piles.

A Colorado study of small mammals and birds in relation to chaining indicated that both abundance and species richness (numbers of species) of mammals increased, with some species increasing dramatically and others decreasing. Varied responses of birds and small mammals suggest that modifications should be made to minimize negative effects of vegetation manipulation.

Impacts on cavity-nesting birds can be lessened by leaving selected cavity trees standing near the perimeter of the chaining. Adverse effects on species commonly associated with edges can be minimized by making the perimeters of chainings irregular, creating an ecotone of smaller trees by using a lighter chain around the edges, and reducing the size of chainings. The use of sunspots (cutting trees in 1- or 2-acre patches separated by an equal space) in conversion of dense woodlands to a more open stand would result in increased forage and browse and in many irregular edges of vegetation (figs. 10-12).

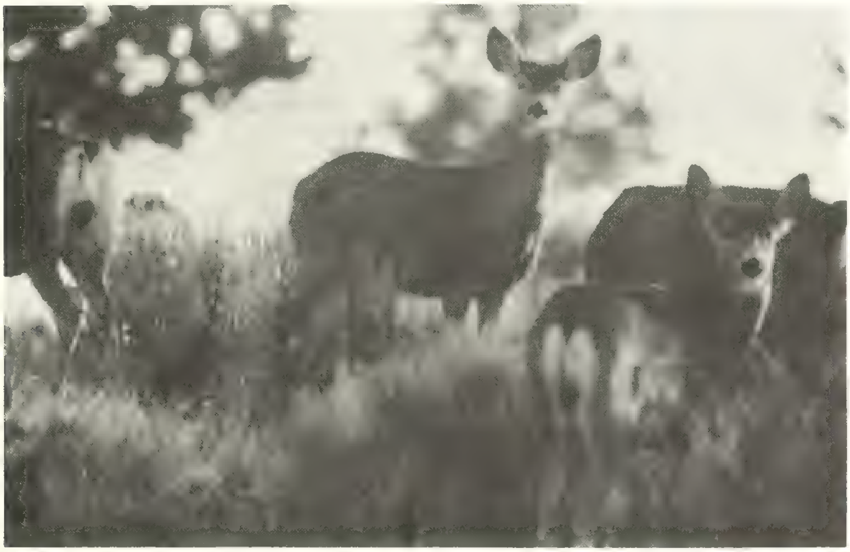

Figure 9—Favorable habitat for deer in pinyon-juniper woodlands is dependent on open areas in the woodlands with browse and forage plants and adjacent cover areas of trees. (Photo by D. A. Klebenow, University of Nevada, Reno, NV.)

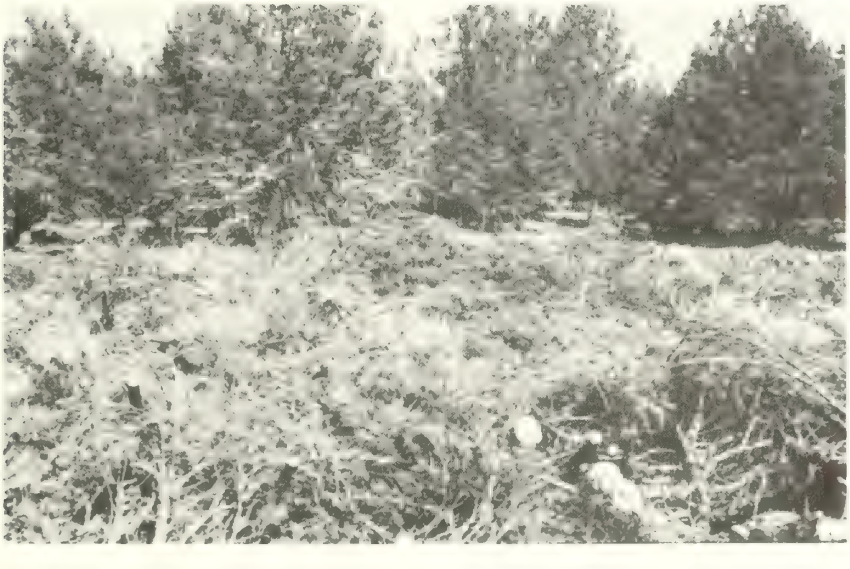

Figure 10—Cutting western juniper trees in small circular areas creates sunspots, opening the stand unobtrusively. With subsequent seeding of forage and browse species where needed, sunspots provide favorable wildlife habitat and increase forage for cattle. (Photo by J. A. Young, Agricultural Research Service, U.S. Department of Agriculture, Reno, NV.)

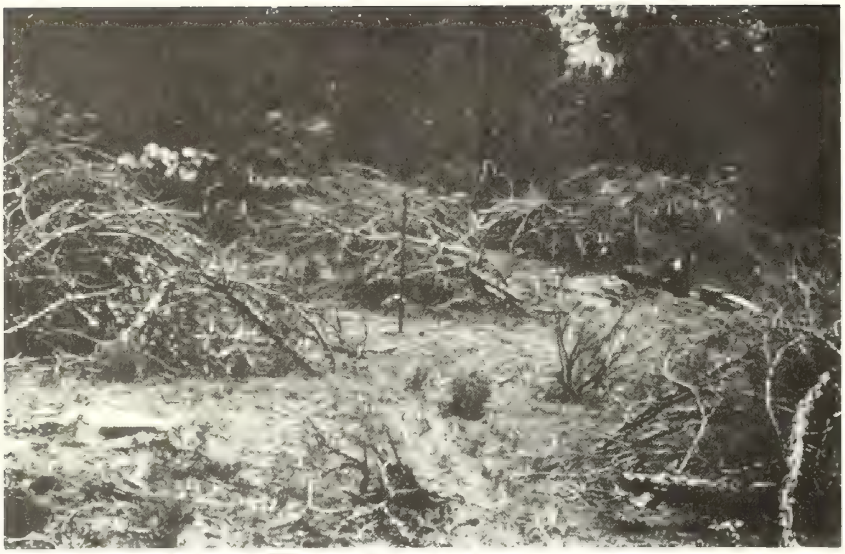

Figure 11—Cutting of trees provides fuelwood to partially offset costs of this labor-intensive range improvement practice.

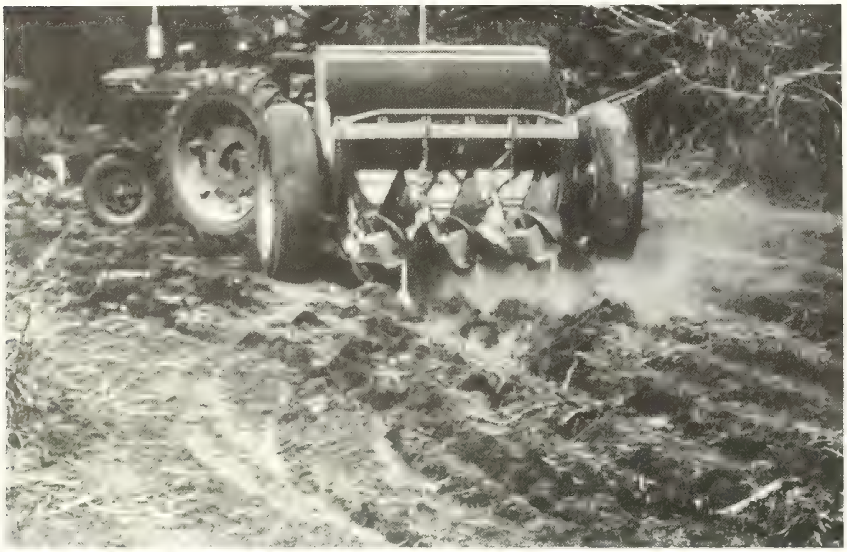

Figure 12—Sunspots are seeded with perennial grasses, forbs, and shrubs with a half-size rangeland drill with deep-furrow arms. Deterrents to successful seeding in these small areas may include annual weed competition and predation of seedlings by deer. (Photo by J. A. Young, Agricultural Research Service, U.S. Department of Agriculture, Reno, NV.)

Management for Watershed Values

A body of knowledge to guide the management of watershed values in pinyon-juniper woodlands does not exist in a practical, comprehensive form. Indeed, only limited research has been done on pinyon-juniper lands, and current management practices have often resulted from applying information extrapolated from studies in other ecosystems. Nevertheless, given the goal of improving and maintaining watershed condition, effective management of the hydrology on pinyon-juniper lands is required.

Part of the problem comes from classification of the woodlands. Pinyon-juniper woodlands describe a wide variety of vegetation and land conditions. Thus, a prevailing need is for a soil-vegetation classification that enables the transfer of hydrologic knowledge gained from research or practice. However, pinyon-juniper woodlands and their ecosystems are not closely linked with specific soils, geology, climate, or associated plant communities, and this increases the difficulty of extending a successful management practice from one site to another and in generalizing the applicability of specific management recommendations to the woodlands as a whole.

Some site-specific research has yielded guidelines. In addition, work has been done to synthesize hydrologic information from similar ecosystems and to apply it to pinyon-juniper sites. But most current watershed knowledge reflects the concerns of the 1960's and 1970's. Hydrologically, these concerns centered on potentials for increasing water yield and the effects of various woodland conversion strategies. At that time, pinyon-juniper woodlands were viewed as undesirable, representing a barrier to increasing grassland cover. However, this perspective has shifted as these woodlands have come to be recognized as a resource for producing a variety of products and as demand for multiple use has intensified. Thus, managers must consider hydrology of the woodlands and watershed management in light of the conflicting demands for forage, fuelwood, fenceposts, pinyon nuts, off-road vehicle travel, and other recreational activities.

Current concerns recognize that a major goal of hydrologic management is to improve on-site watershed conditions, such as reducing rates of runoff and sediment production and increasing infiltration rates. Following are some highlights of current knowledge concerning watershed management.

PRECIPITATION

Although total precipitation is relatively low in the pinyon-juniper ecosystem, short-duration, high-intensity rainfall can result in significant erosion from specific sites. Watershed studies at locations in the Southwest and Intermountain areas, although not in the pinyon-juniper ecosystem, indicate the importance of these high-intensity rainstorms. Studies at four Safford, AZ, watersheds indicate 5-minute intensities approaching 8 inches per hour. Results of a study of maximum 2-minute rainfall intensities for 41 stations in Idaho, Utah, New Mexico, and Arizona translate to 5-minute rates ranging from 17 inches per hour at Reynolds Creek, ID, to as high as 42 inches per hour at Alamogordo, NM. These results indicate that the absolute rate of rainfall can overwhelm infiltration capacity of soils. However, the total volume per storm gives land managers an opportunity to apply land treatments to increase surface retention.

For example, contour furrows, pitting, and ripping can all have a significant effect on reducing on-site erosion. Contour ripping to a 24-inch depth on a 6-ft spacing has the initial capacity to retain 1 inch of runoff on site. Using large contour furrows can effectively control up to 3 inches of runoff.

INTERCEPTION

Interception of snow and rain by trees in the pinyon-juniper woodlands can be a significant factor affecting total amount of precipitation hitting the soil surface. Results of an Arizona study indicated that average interception in the Utah juniper type during a single year of measurement was 17.2 percent of the annual precipitation for that year. Also reported in this study were interception values of 0.13 to 0.94 inches for a single high-intensity storm. An interception capacity of 0.2 inches of precipitation would reduce the effective 5-minute intensity by 2.4 inches per hour.

In the western juniper type in northeastern California, a 4-year study indicated that interception was between 15 and 20 percent in an even-aged stand of 40 percent crown canopy. Under the edge of western juniper canopies, interception was about 20 percent, in the middle of the canopy it was 50 percent, and at the trunk interception increased to two-thirds of the precipitation. Interception was the same in all seasons.

A second study in Arizona showed no significant difference between pinyon and juniper throughfalls, indicating that interception by the two trees was similar. No specific studies have been done on interception by litter in pinyon-juniper woodlands, but its effect might be significant in accounting for reduction of the intensity of rainstorms.

Calculated annual interception differences (based on the Arizona data) among three chaining treatments in Utah indicated that the greatest interception would occur in undisturbed woodlands and that the annual interception rates on chained and windrowed or chained with debris in place would be from 30 to 90 percent of interception in undisturbed woodlands, depending on the year.

INFILTRATION

Infiltration studies in pinyon-juniper woodlands have received the greatest amount of attention by watershed scientists. The following is the current state of knowledge.

1. Average measured infiltration rates range from 1.2 to 2.0 inches per hour for soils at field capacity and approximately 2.5 inches per hour for dry soils. Rainfall rates are more than these infiltration rates, indicating that surface runoff will occur.
2. Little difference in infiltration rates exists between undisturbed and chained plots.
3. Increased mechanical disturbance associated with windrowing may result in reduced infiltration.
4. Grazing impacts are detectable for a single season and are cumulative. In one instance, protection of the site from grazing for 4 years was necessary to restore maximum infiltration capacity.
5. Burning appears to reduce infiltration rates.
6. Researchers have encountered difficulty in identifying a consistent set of easily measurable factors that influence infiltration rates.
7. Cryptogamic soil crusts increase surface roughness, increase infiltration, reduce intrinsic permeability, provide soil protection, and are slow to recover from disturbance.

RUNOFF

The pinyon-juniper ecosystem generally produces surface runoff in response to high-intensity, short-duration rainstorms. These storms typically produce high unit area rates of runoff on small areas. One study showed a measured rate of flow of 400 to 700 ft^3 per second per square mile (CFSM). Research also showed a 60 percent increase in peak discharge from a cabled watershed. In the Saliz Watershed in New Mexico, a rate of 1,380 CFSM for the 0.3-mi^2 watershed was reported. The Saliz Watershed was heavily grazed. Significant runoff has not been observed since subsequent tree removal, contour furrowing, and reseeding were completed in 1964. Current information on magnitude and frequency of storm runoff related to specific site conditions is inadequate for design of facilities in pinyon-juniper ecosystems.

SURFACE DETENTION

Pits resulting from cabling juniper have been estimated to retain an average of 0.18 inches potential runoff per storm. Other properly applied mechanical treatments, such as pitting, ripping, contour furrowing, and contour trenching used in combination with clearing can provide detention storage ranging from 0.6 to 3.5 inches or more of runoff.

SEDIMENT PRODUCTION

Sediment production is the primary water quality concern from pinyon-juniper ecosystems. Limited information exists for evaluating differences in sediment production between treated and untreated watersheds. At Beaver Creek, AZ, limited data indicate average annual sediment rates of 0.07 tons per acre in winter and 0.03 tons per acre in summer from untreated watersheds. In contrast, a cabled watershed produced annual sediment rates ranging from a trace to 1.1 tons per acre.

WATER YIELD IMPROVEMENT

The pinyon-juniper ecosystem produces no significant water yield, and most attempts to increase water yield in this vegetation type have produced only marginal results. Small openings may trap snow and increase water available for plant growth. Vast clearing of pinyon-juniper woodlands may produce the opposite effect because of wind-blowing snow.

WATER HARVESTING

Water harvesting is a management technique that can provide the necessary quantity and distribution of animal drinking water on lands used for livestock grazing. Because livestock grazing is a primary use on many pinyon-juniper lands, water harvesting holds much potential value for proper management of this resource.

Water harvesting is the collection and storage of precipitation from a small catchment area that is topographically modified, chemically treated, or covered with a membrane to reduce infiltration. Although water harvesting is a relatively costly method of water supply augmentation, it nevertheless can be used where other methods, such as wells, spring development, water hauling, and pipelines, are not feasible.

FUTURE TRENDS AND NEEDS

Current use of pinyon-juniper woodlands is expanding. New and innovative practices are needed to respond to these demands while maintaining and improving the productive potential. Maintaining on-site productivity and water quality requires development and application of appropriate management practices. Some of the areas of concern are (1) road location and design to control runoff and erosion, (2) level of constraints or mitigation to control off-road vehicle use, (3) livestock management strategies that provide greatest production with least resource impact, and (4) fuelwood and Christmas tree harvesting to maximize long-term production and maintain favorable watershed conditions.

Successful watershed maintenance and improvement strategies will require resolution of the following:

1. What constitutes satisfactory watershed condition and what can be used to assess it?
2. What influence does high-intensity, short-duration rainfall have on selection of management strategies and their accompanying treatment strategies?
3. Do differences in the spatial distribution of ground cover produce different runoff results? (As an example, is there a difference between 30 percent cover concentrated under trees and 30 percent cover of grass and litter uniformly distributed over the same site?) What role does overstory interception play with respect to short-duration storms?
4. What management strategies are available to deal with vertisols and vesicular soils?
5. What is the current influence of pinyon-juniper woodlands on riparian conditions? What management strategies provide greater protection for riparian and other downstream values?

Management for Recreational Values

Recreational values and activities are highly diverse and varied in the pinyon-juniper woodlands. Managers should keep in mind the needs of the people visiting the woodlands and how they would view the results of certain management and conversion practices, especially those that disrupt the natural setting. Esthetics are important to most people visiting these lands, so in areas where wildlife or livestock management objectives dictate tree removal or other conversion of the woodlands, managers should be aware of how this activity will be viewed. The killing and removal of trees from small, irregularly shaped areas are usually more acceptable to the public than from large rectangular blocks.

Also needed is the continual education of the public about the real nature of the pinyon-juniper woodlands and what agencies are trying to achieve with specific conversion practices that are essential for successful management of these areas. Public understanding and support for management of pinyon-juniper woodlands should be one of the prime objectives of each manager having responsibility for their maintenance.

Custodial Management

Custodial management has been defined as managing to protect existing resource values and prevent further deterioration. A more accurate definition when applied to pinyon-juniper woodlands is the management practice used where none of the other management alternatives such as type conversion for wildlife or livestock, or management for sustained yield of fuelwood or other woodland products, are cost effective. Essentially, as practiced today in the pinyon-juniper woodlands, custodial management is nonmanagement. However, on some public lands there has been a recent trend of moving away from custodial management even though it is to a rather extensive level of maintaining 200 to 400 trees per acre.

Ample evidence suggests that nonmanagement of the pinyon-juniper woodlands leads to site degradation, increased soil erosion, depleted understory production, and a stagnant and unhealthy overstory of trees.

Succession in the pinyon-juniper woodlands favors tree dominance over the understory vegetation, so when these woodlands are not managed, trees become dominant and the understory of shrubs, grasses, and broadleaf plants dies out. Often, this leaves only bare ground under the trees and, in some cases, the skeletons of dead shrubs as the only understory remnant. These are conditions that foster erosion of the top soil and the occurrence of devastating fires that in turn lead to further degradation of the woodlands.

Integrated Management of Overstory and Understory Vegetation for Multiple Uses

The pinyon-juniper woodlands, because of the demand for products other than wood, particularly forage for livestock and wildlife habitat, provide an opportunity to practice multiple-use silviculture. The management of these lands for multiple use does not mean that every acre should or can be managed in relation to the entire spectrum of uses. Different sites have different potentials for plant growth and a different potential for use. The woodlands that are now used for fuelwood harvesting will probably continue to be important for that use because of location and site potential. Although these woodlands should be managed primarily for fuelwood production and harvest, the cutting of trees often presents the opportunity for increased forage production and improved wildlife habitat as secondary uses and benefits.

Livestock grazing or wildlife habitat are sometimes the primary benefit or management objective of a specific area of pinyon-juniper woodlands, especially where fuelwood harvesting cannot be considered as a current, valid use of the woodlands because of remoteness or inaccessibility. In such areas, judicious tree control should be considered for increased forage production and wildlife habitat improvement.

Much of the pinyon-juniper woodland has low productivity and marginal economic usefulness. These are the lands that should be under custodial management, but even they should be managed, at least extensively, to ensure that the resource is maintained. There are many such lands that are not important for their commodities but are essential for watershed and wildlife values.

SUMMARY

Pinyon-juniper woodlands are made up of many diverse ecosystems in the Western United States. Pinyon and juniper trees grow on many types of soils, on varied topography, and with different climatic regimes. Occurrence and dominance of trees vary over the spectrum of the woodlands, as do understory species.

Not only do we find great diversity in the characteristics of pinyon-juniper woodlands, but uses of these woodlands also vary widely from fuelwood harvesting, providing fenceposts, Christmas trees, and pine nuts to livestock production and wildlife habitat.

These woodlands represent a many-faceted, fragile, everchanging resource with multiple demands on it for products and uses. Coordinated resource management and planning can provide tools for identifying proper management strategies and alternatives and at the same time will protect resource values and prevent further deterioration of the lands.

The challenge is great for the people charged with responsibility of managing this resource to satisfy the demands made upon it and still preserve it as a viable, productive ecosystem.

The objectives of this manual are to provide an overview of the pinyon-juniper woodlands and to emphasize basic principles for their management to guide managers in making decisions based on the latest information. Because these principles cover an extremely diverse ecosystem, they should be considered only as general guides for the management of particular areas to be supplemented by more specific information and on-the-ground evaluation.

Many published sources detail specific methods for management and improvement of rangelands that can be used in pinyon-juniper woodlands. Some of the more relevant and comprehensive publications are listed in the references section.

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APPENDIX 1: COMMON AND SCIENTIFIC NAMES OF PLANTS, ANIMALS, AND BIRDS (ALPHABETICALLY LISTED BY COMMON NAME)

Common name	Scientific name
PLANTS	
alfalfa	*Medicago sativa*
bitterbrush, antelope	*Purshia tridentata*
bitterbrush, desert	*Purshia glandulosa*
bluestem, little	*Andropogon scoparius*
burnet	*Sanguisorba minor*
cactus	*Opuntia* spp.
cercocarpus, alderleaf	*Cercocarpus montanus*
cercocarpus, birchleaf	*Cercocarpus betuloides*
cheatgrass	*Bromus tectorum*
cherry, bitter	*Prunus emarginata*
chokecherry, black	*Prunus virginiana* ssp. *melanocarpa*
cholla, walkingstick	*Opuntia arborescens*
cliffrose, Stansbury	*Cowania mexicana stansburiana*
Douglas-fir	*Psuedotsuga menziesii*
fescue, sheep	*Festuca ovina*
flax, blue	*Linum perenne*
flax, Lewis	*Linum perrenne lewisii*
galleta	*Hilaria jamesii*
grama, blue	*Bouteloua gracilis*
gramma, black	*Bouteloua eriopoda*
gramma, sideoats	*Bouteloua curtipendula*
juniper, alligator	*Juniperus deppeana*
juniper, oneseed	*Juniperus monosperma*
juniper, Rocky Mountain	*Juniperus scopulorum*
juniper, Utah	*Juniperus osteosperma*
juniper, western	*Juniperus occidentalis*
kochia, forage	*Kochia prostrata*
lovegrass, Boer	*Eragrostis chloromelas*
lovegrass, Lehmann	*Eragrostis lehmanniana*
lovegrass, weeping	*Eragrostis curvula*
manzanita	*Arctostaphylos* spp.
muhly, spike	*Muhlenbergia wrightii*
oak, Gambel	*Quercus gambelii*
oak, scrub live	*Quercus turbinella*
oak, wavyleaf	*Quercus undulata*
orchardgrass	*Dactylis glomerata*
penstemon, Palmer	*Penstemon palmeri*
penstemon, Rocky Mountain	*Penstemon strictus*
pine, lodgepole	*Pinus contorta*
pine, ponderosa	*Pinus ponderosa*
pinyon, Mexican	*Pinus cembroides*
pinyon, singleleaf	*Pinus monophylla*
pinyon, two-leaf	*Pinus edulis*
rabbitbrush	*Chrysothamnus* spp.
ricegrass, Indian	*Oryzopsis hymenoides*
sagebrush, basin big	*Artemisia tridentata* ssp. *tridentata*
sagebrush, mountain big	*Artemisia tridentata* ssp. *vaseyana*
sagebrush, Wyoming big	*Artemisia tridentata* ssp. *wyomingensis*
PLANTS (con.)	
sagebrush, black	*Artemisia arbuscula nova*
saltbush, fourwing	*Atriplex canescens*
serviceberry, Saskatoon	*Amelanchier alnifolia*
skunkbush, sumac	*Rhus trilobata*
thistle, Russian	*Salsola kali tenuifolia* *(S. iberica)*
tumblemustard	*Sisymbrium altissimum*
wheatgrass, bluebunch	*Agropyron spicatum*
wheatgrass, standard crested	*Agropyron desertorum*
wheatgrass, crested ('Hycrest')	*Agropyron cristatum* x *A. desertorum*
wheatgrass, intermediate	*Agropyron intermedium*
wheatgrass, western	*Agropyron smithii*
wildrye, basin	*Elymus cinereus*
wildrye, medusahead	*Taeniatherum asperum*
wildrye, Russian	*Elymus junceus*
winterfat	*Erotia lanata* *(ceratoides lanata)*
yucca	*Yucca* spp.
ANIMALS	
badger	*Taxidea taxus*
bobcat	*Lynx rufus*
buffalo	*Bison bison*
cattle	*Bos taurus*
coyote	*Canis latrans*
deer	*Odocoileus hemionus*
desert bighorn sheep	*Ovis canadensis*
elk	*Ceruus elaphus*
horse	*Equus caballus*
jackrabbit	*Lepus* spp.
lagamorph	Order: Lagamorpha
mouse	*Peromyscus* spp.
mountain lion	*Felis concolor*
mule deer	*Odocoileus hemionus*
porcupine	*Erethizon dorsatum*
pronghorn antelope	*Antilocapra americana*
rabbit	*Lepus* and *Sylvilagus* spp.
squirrel	*Spermophilus* spp.
vole	*Microtus* spp.
woodrat	*Neotoma* spp.
BIRDS	
bald eagle	*Haliaeetus leucocephalus*
Clark's nutcracker	*Nucifraga columbiana*
falcon	*Falco* spp.
golden eagle	*Aquila chrysaetos*
hawk	*Accipiter* spp.
kestrel	*Falco* spp.
owl	Families:Tytonidae, Strigidae
pinyon jay	*Gymnorhinus cyanocephalus*
robin	*Turdus migratorius*
scrub jay	*Alphelocoma coerulescens*
Steller's jay	*Cyanocitta stelleri*

APPENDIX 2: CHARACTERISTICS OF JUNIPERS (*JUNIPERUS* SPP.)

	Species				
Characteristic	Alligator (*deppeana*)	One-seed (*monosperma*)	Utah (*osteosperma*)	Western (*occidentalis*)	Rocky Mountain (*scopulorum*)
Fruit	Brownish with whitish bloom mealy 3-5 seeds	Dark blue soft, juicy 1 seed	Bluish with bloom mealy 1-2 seeds	Blue-black soft, juicy 2-3 seeds	Bright blue whitish coat soft, juicy 2 seeds
Bark	Blackish or gray thick and rough furrowed into plates	Gray fibrous and shreddy	Gray fibrous furrowed and shreddy	Reddish brown furrowed and shreddy	Reddish brown thin, fibrous and shreddy
Leaves	Blue-green with gland dot	Yellow-green with gland dot	Yellow-green without gland dot	Gray-green with gland dot	Gray-green
Branching habit	Short stout trunk with rounded, spreading crown	Several branches curving up from ground much branched snaggly crown	Short upright trunk with spreading branches open crown	Short trunk broad crown spreading branches ragged and gnarled with age	Straight trunk, narrow pointed crown, slender branches
Regeneration	Sprouting, seed	Seed	Seed	Seed	Seed
Distribution-range	Central and Southeastern Arizona; central New Mexico	Central and Southeastern Arizona; New Mexico; south central Colorado	Nevada, Utah, western Colorado; northeastern and central Arizona	Sierras, northeastern California, eastern Oregon, and western Nevada	Colorado, Utah, Idaho, western New Mexico, and central Arizona

APPENDIX 3: CHARACTERISTICS OF PINYONS (*PINUS* SPP.)

Characteristic	Species Two-leaf (*edulis*)	Single-leaf (*monophylla*)	Mexican (*cembroides*)
Needles	2 in bundle; long, stout light green	1 in bundle; stout stiff, sharp pointed; dull gray-green with whitish lines	3 in bundle; slender, flexible, with white lines
Bark	Gray to reddish brown; rough, furrowed with scaly ridges	Dark brown or gray; smoothish, becoming furrowed into scaly plates and ridges	Light gray and smooth
Cones	1.5-2 inches long egg-shaped yellow-brown resinous	2-3 inches long egg-shaped dull yellow-brown almost stalkless	0.75-2 inches long egg-shaped almost stalkless resinous
Seeds	Large, wingless, slightly thick walled, oily	Large, wingless, thin-walled, mealy	Large, wingless, dark brown, thick-walled
Stature	Small, bushy resinous tree with short trunk	Small, rounded, gray-green crown with low horizontal branches, often shrubby	Small, resinous tree with short trunk and spreading crown
Distribution-range	Arizona, New Mexico, Utah, and Colorado widespread	Nevada and western Utah widespread	Southeastern Arizona and southwestern New Mexico limited distribution

APPENDIX 4: SOIL ORDERS FOUND IN PINYON-JUNIPER WOODLANDS

Alfisols—These soils have a profile that is both massive and hard when dry and possess an argillic horizon or layer that water cannot penetrate. Alfisols have water that is held at less than 15 bars during at least 3 months each year when the soils are warm enough for plants to grow.

Aridisols—Soils of this order dc not have water available to mesic plants for long periods. During most of the growing season, water is held at above 15 bars and thus unavailable to plants. These soils have well-developed horizons that were formed under low soil moisture and have little or no leaching through the profile. Typical features of Aridisols are lime layers, salt or gypsum accumulations, low organic matter accumulation, and a calcareous profile. They have one or more horizons that may have been formed in the present environment or that may be relicts from a former pluvial period. The surface soil is usually light in color and soft in consistency. Natural vegetation usually consists of shrubs, and a few ephemeral grasses and forbs. Aridisols are the most abundant soil order worldwide and are found in low rainfall areas.

Entisols—These soils have only slight soil development with little or no development of soil horizons. They range from deep sands to stratified river-deposited clays. Entisols are highly erodible.

Inceptisols—These soils are weakly developed but more so than Entisols. Reasons for only slight development may be that they were derived from recent deposits, have parent material that resists weathering, erosion might be fast enough to remove developing soil, or wetness and cold may slow down translocation and weathering to allow the Inceptisol characteristics to persist.

Mollisols—These are mainly dark-colored, base-rich soils that generally have good grass cover. Some of them may have formed under forests. The surface horizon is usually thick, dark in color, strong in structure because of high organic matter, and more than 50 percent saturated with bases. Soils of this order are between Aridosals of arid climates and Alfosols of humid climates.

Vertisols—These clayey soils have deep, wide cracks at some time of the year. In the rainy season the cracks swell shut and in the dry summer they reopen. In arid areas, these soils develop in closed basins or playas. The parent material is high in limestone, marls, or basic rocks, such as basalt. Most Vertisols support grass or other herbaceous vegetation or open forests.

APPENDIX 5: VOLUME AND GROWTH EQUATIONS FOR PINYON-JUNIPER WOODLANDS

Volume Prediction Model

$$V = [B_0 + B_1X^{1/3} + B_2S]^3$$

where

V = volume of all wood and bark having branch diameters larger than 1.5 inches (ft^3)

X = diameter near root collar (inches) squared times total tree height (ft)

S = 1 for a single-stem tree, 0 otherwise

B_i = coefficients estimated by linear regression using a cube root transformation.

This model uses a cube root transformation to fit visual segmentation volume data collected throughout the central Rocky Mountain States.

Growth Prediction Model

$$G = \exp [B_0 + B_1\ln(X_1) + B_2\ln(X_2) + B_3X_3]$$

where

G = sum of current annual volume growth (CAI) or sum of average volume growth (MAI)

X_1 = crown volume variable

X_2 = basal area growth or basal area combination variables

X_3 = juniper crown cover variable.

CAI was best modeled as a function of (1) total crown volume, (2) total basal area growth, and (3) percentage of juniper crown cover. Crown volume, the most important variable reflecting photosynthetic potential for a pinyon-juniper stand, was computed from a geometrical formula (ellipsoid or paraboloid) using crown diameter and height measurements. Basal area growth, the second most important variable, seemed to function as a measure of site quality. Percentage of juniper cover distinguishes the amount of juniper compared to that of pinyon on the site.

For modeling MAI, crown volume was the most important variable. The second best variable involved basal area—either basal area divided by median stand age or alone. The third variable was amount of juniper cover.

Equations for both models are from Chojnacky, David C. 1986. Volume and growth prediction for pinyon-juniper. In: Everett, Richard L., compiler. Proceedings—pinyon-juniper conference. Gen. Tech. Rep. INT-215. Ogden, UT: U.S. Department of Agriculture, Intermountain Research Station: 207-215

APPENDIX 6: REVEGETATION SPECIES FOR PINYON-JUNIPER WOODLANDS

Sites are so varied in the pinyon-juniper woodlands that information concerning the best adapted species, selection, and cultivar of revegetation species for specific conditions should be obtained from local workshops or from sources listed in the "References" section.

Common name	Improved cultivars, selections, or subspecies
Grasses:	
Wheatgrass, bluebunch	Whitmar, Secar
crested	Hycrest
intermediate	Oahe, Greenar, Amur
standard crested	Nordan
western	Barton, Arriba, Rosanna
Wildrye, basin	Magnar
Russian	Vinall, Bozoisky - Select
Galleta	Viva
Gramma, blue	Lovington, Hachita
black	
sideoats	Vaughn, Niner
Ricegrass, Indian	Nezpar, Paloma
Lovegrass, Boer	
Lehmann	
weeping	
Muhly, spike	El Vado
Bluestem, little	Pastura, Cimarron
Fescue, sheep	Covar
Orchardgrass	Paiute
Forbs:	
Flax, Lewis	Appar
Penstemon, Palmer	Cedar
Rocky Mountain	Bandera
Alfalfa	Rambler
Burnet	
Shrubs:	
Bitterbrush, antelope	Many selections
desert	
Cliffrose, Stansbury	
Winterfat	Hatch
Saltbush, fourwing	Rincon
Kochia, forage	Immigrant
Sagebrush, big	Mountain Wyoming Basin
Rabbitbrush	

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This manual, intended to be used by land managers, natural resource management students, and users of the woodlands, is a current state-of-the-art summary and compilation of information on the ecology and management of pinyon-juniper woodlands.

KEYWORDS: forest products, range management,wildlife habitat, watershed and hydrology, multiple-use management, recreation, ecosystem analysis, Great Basin, Southwestern United States

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**Intermountain
Research Station**

General Technical
Report INT-250

December 1988

Aspen Community Types of the Intermountain Region

Walter F. Mueggler

PUBLIC DOCUMENT

RESEARCH SUMMARY

This vegetation classification for the aspen-dominated forests of the Forest Service's Intermountain Region is based on existing community structure and plant species composition. Included are 56 community types that occur within eight tree-cover types. The types are grouped into three abundance categories (major, minor, incidental). Only 14 of the types are required to describe approximately two-thirds of the aspen stands within the Region. A diagnostic key using indicator species facilitates field identification of the community types. The key is followed by narrative descriptions of the distribution, vegetal composition, successional status, and the forage and wood fiber productivity of each type. Appendix tables provide detailed comparisons of the types. The classification and descriptions are based [illegible]ld data from over 2,100 aspen stands scattered over southeastern Idaho, western Wyoming, Utah, and Nevada.

THE AUTHOR

WALTER F. MUEGGLER, now retired, was principal plant [illegible] and project leader of the Intermountain Research [illegible] Aspen Ecology and Management research work [illegible]ogan, UT. He has conducted research on aspen woodlands for over 10 years. He holds degrees in forestry from the University of Idaho and ecology from the University of Wisconsin, and a Ph.D. degree in plant ecology from Duke University.

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Special recognition is given for the able assistance of Robert R. Campbell, Jr., formerly a botanist with the Intermountain Station's Aspen Ecology research work unit, who not only participated fully in field phases of work in Idaho, Utah, and Nevada, but was indispensable in preparing data for analysis and resolving computer processing problems. He coauthored two of the preliminary publications related to this work. The current analysis and interpretations are the sole responsibility of the author.

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Aspen Community Types of the Intermountain Region

Walter F. Mueggler

INTRODUCTION

Western wildlands are covered by a broad spectrum of vegetation zones, from dense forests to barren deserts. Each of these major zones consists of a melange of plant communities, differing in species composition and potential productivity, which are dependent upon sometimes rather subtle environmental influences as well as upon direct and indirect human impacts. Indeed, wildland managers must contend with what often appears to be a chaotic assemblage of overlapping land and vegetation units, each with its own combination of resource values and management sensitivities. Intensive management of these wildlands requires an ability to recognize the units of land and vegetation with similar production capabilities and similar response to management activities. Classification serves to create order out of this chaos. Increasing emphasis on intensive management of our wildlands has thus stimulated efforts in recent years to develop detailed classification systems for these wildlands.

Within the Intermountain Region of the Forest Service, U.S. Department of Agriculture, wildland classifications have been developed for the sagebrush-grass communities of southern Idaho (Hironaka and others 1983), the subalpine forb communities in western Wyoming (Gregory 1983), riparian communities of eastern Idaho, western Wyoming, and northern Utah (Youngblood and others 1985a, 1985b), the coniferous forests of southern Idaho and western Wyoming (Steele and others 1981, 1983), and the coniferous forests of Utah (Mauk and Henderson 1984; Youngblood and Mauk 1985). My own efforts have centered on the development of a classification for the extensive and important aspen woodlands of the Intermountain Region (Mueggler and Campbell 1982, 1986; Youngblood and Mueggler 1981).

Western forests dominated by aspen (*Populus tremuloides* Michx.) are highly regarded by most resource managers for their ability to provide a wide variety of benefits. They are a classic example of multiple-use wildlands. Traditionally valued in the interior West as luxuriant summer range for livestock, they are also considered prime habitat for many species of wildlife, productive watersheds, and significant contributors to western scenery (DeByle and Winokur 1985). Although these lands historically have been an important local source of fuel and wood products where other trees are scarce, such as in portions of Nevada, their production of wood fiber has not been used appreciably where coniferous forests are common. Aspenlands continue to provide a valuable summer grazing resource for cattle and sheep (Mueggler 1985b), although the number of livestock on these lands has been reduced from the excessive levels present at the turn of the century. Reduced livestock use has been offset by increased recognition of the importance of these lands as habitat for many wildlife species (DeByle 1985). Perhaps the most influential change in use of resources produced by these lands relates to wood fiber. Demand for aspen as a fuelwood has increased markedly (Pierson 1981), as has interest in aspen in the production of waferboard and other such fiber products (Wengert and others 1985). Increased use of wood from these lands greatly increases the options and feasibility of management to improve all resource values.

Distribution

Aspen-dominated woodlands are a major forest type in many portions of the interior West. The Intermountain Region alone contains over 2.5 million acres (1 million ha) of aspen forests (Green and Van Hooser 1983), or almost 10 percent of the total forested area (if pinyon-juniper woodlands are excluded). These aspen forests range in size from small, isolated groves to broad expanses of pure and mixed stands. Utah has approximately 1.6 million acres (650,000 ha) of aspen, much of which occurs in extensive stands (fig. 1). This amounts to almost a fourth of Utah's forests. Considerably less aspen is found in southern Idaho and western Wyoming, approximately 800,000 acres (324,000 ha), but it usually occurs as conspicuous small, scattered groves that are a highly valued part of the landscape.

Nevada, the driest State in the Union, has almost 250,000 acres (100,000 ha) of aspen-dominated woodlands. These are widely distributed throughout many of the higher mountain ranges of the State where moisture and temperature relationships are suitable for the growth of this relatively mesic species. But compared to the extensive and well-formed stands of Utah, aspen growth in Nevada is marginal. It tends to occur there as small to medium-size groves in the specialized environments of high-elevation basins, swales, draws, and on the lee side of ridges where snow frequently accumulates (fig. 2).

Environment

Aspen grows on a wide variety of upland sites in the Intermountain Region. This broad environmental amplitude is reflected in its being the most widely distributed tree species in all of North America (Little 1971). It is found on soils derived from various igneous, sedimentary, and metamorphosed parent rock, but it appears to grow best on limestones, basalts, and neutral or calcareous

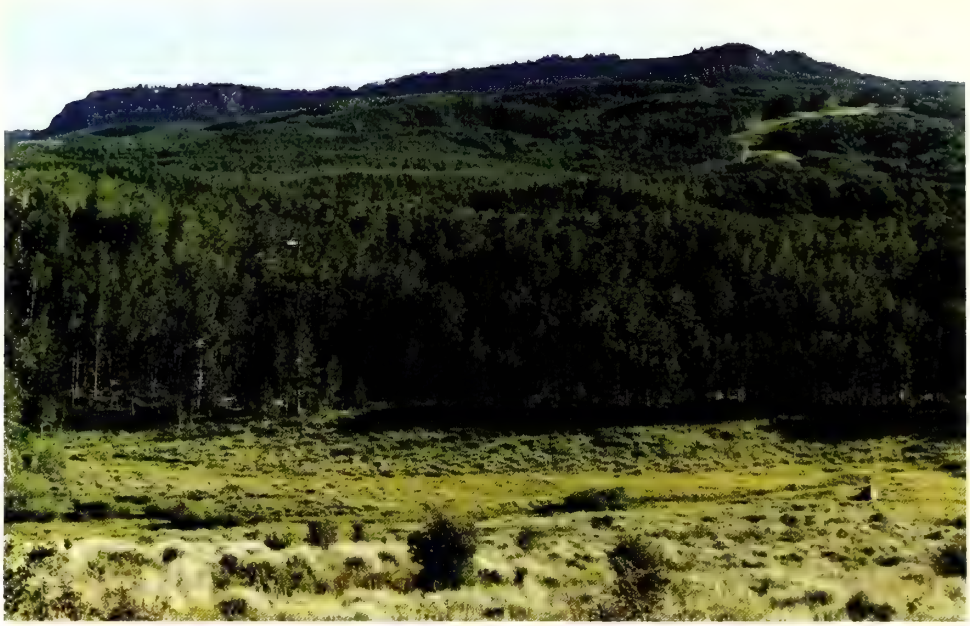

Figure 1—Aspen-dominated woodlands, such as these extensive stands in central Utah, make up approximately 10 percent of the Intermountain Region's forests.

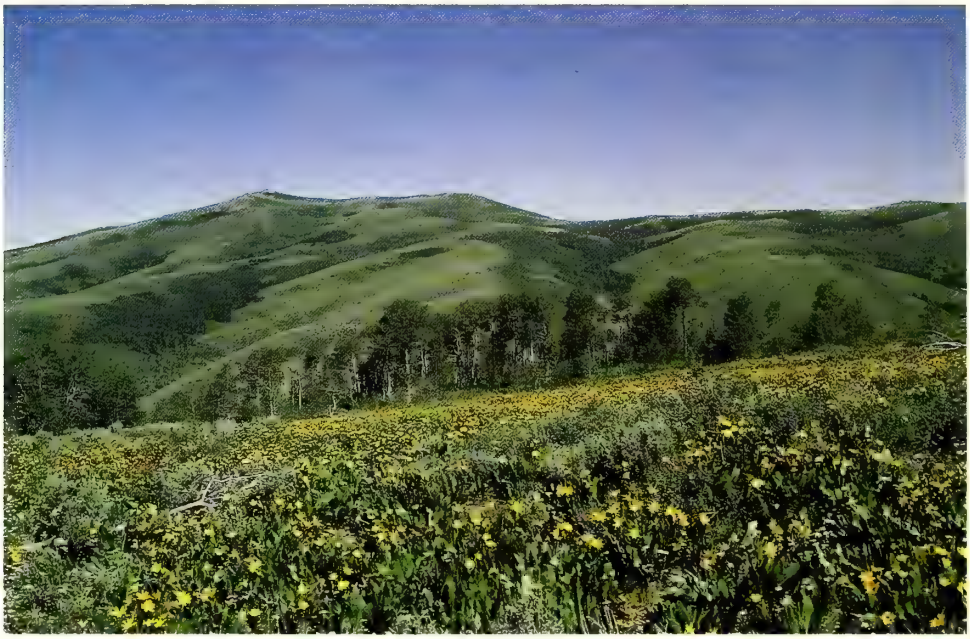

Figure 2—In the drier parts of the Intermountain Region, such as here on the Humboldt National Forest in northeastern Nevada, aspen commonly occurs as scattered groves in relatively moist swales and basins where its importance to wildlife is especially great.

shales (Jones and DeByle 1985a). Aspen's growth appears to be limited primarily by adequacy of the soil moisture required to meet its heavy evapotranspirational demands. Therefore, in the Intermountain Region the species is usually confined to relatively moist sites with at least 15 inches (38 cm), but more commonly over 20 inches (51 cm), annual precipitation, cold winters, deep snows, and reasonably long growing seasons (Jones and DeByle 1985b). Accumulation zones of subsurface moisture and the ameliorating effects of topography on evapotranspiration are usually critical in permitting aspen to occupy sites at its lowest limits of precipitation.

Elevational limits of aspen within the Region range from approximately 5,200 to 10,500 ft (1,580 to 3,200 m). The elevations of most common occurrence, as well as elevational limits, generally increase with decreasing latitude (table 1). For example, the modal elevation for aspen stands in the northern part of the Region in southeastern Idaho and western Wyoming, between 42° and 44° latitude, is 6,600 ft (2,000 m). In the southern part of the Region between approximately 37.5° and 39° latitude the modal elevation is 8,800 ft (2,680 m). Aspen in northern Nevada, between 41° and 42° latitude, has a modal elevation of 6,800 ft (2,070 m). Its modal elevation farther south, between 38.5° and 39.5° latitude, is 9,500 ft (2,900 m). At its lowest elevations, especially in Nevada and southern Utah, aspen occurs frequently as stringers confined to riparian environments that may extend downward to elevations 500 to 1,000 ft (150 to 300 m) below the zone of usual occurrence. Upper elevational limits appear to be determined primarily by length of growing season, and lower elevational limits by evapotranspiration. Aspen at the upper elevations is commonly restricted to southerly exposures, whereas that at the lower elevations tends to occur on northerly and easterly exposures or in swales and draws that are collectors of precipitation runoff.

As a species, aspen is adapted to a much broader range of environments than most plants found associated with it. Aspen is one of the few plants able to grow in all mountain vegetational zones, from the alpine tundra to the basal plains (Daubenmire 1943). As a consequence, it can be found as part of the vegetation mosaic of a broad range of zones. Aspen frequently occurs at its lowest elevations as stringers or small islands on the fringe of the semiarid sagebrush-grass steppes. At intermediate elevations it usually is found as pure or mixed stands interspersed among a variety of coniferous forest types or as groves among forest-herbland ecotones. At the higher elevations within the Intermountain Region, it functions primarily as a seral dominant tree within the cool, moist, spruce-fir forest habitat types. The overstory and undergrowth species within the aspen-dominated forests at these various elevations in part reflect species composition of these adjacent vegetation types.

Succession

Successionally, aspen functions both as a seral species in habitat types where conifer trees are climax, and as a climax dominant in aspen forest habitat types. The abundance of aspen throughout much of the interior West is believed to result from the historic prevalence of wildfires in the coniferous forest zones. Aspen reproduces vigor-

Table 1—Relation between latitude and the elevation where aspen forests occur in the Intermountain Region

Area	Latitude range	80 percent elevational range[1]	
		Feet	*Meters*
Western Wyoming SE Idaho (N=511)[2]	42°-44°	6,000-8,200	1,828-2,500
Northern Utah (N=484)	40 1/2°-42°	6,500-8,900	1,981-2,713
Southern Utah (N=295)	37 1/2°-39°	8,100-9,700	2,469-2,957
Northern Nevada (N=190)	41°-42°	6,500-7,700	1,981-2,347
Southern Nevada (N=151)	38 1/2°-39 1/2°	8,000-9,700	2,438-2,957

[1] Excluding the lower 10 percent and upper 10 percent of aspen stands examined.
[2] Number of aspen stands.

ously by root suckers following fire. It is thus able to dominate a site more rapidly than conifers, which depend upon seed for regeneration. Aspen may dominate the forest community on conifer-climax sites for many decades, even centuries, but will gradually decline as the more shade-tolerant conifers become reestablished. However, the role of wildfires in maintaining aspen communities in the West has changed. DeByle and others (1987) have determined that it would take approximately 12,000 years to complete a fire cycle under the present regimen of wildfires. Thus, many stands once dominated by aspen are well along in the process of replacement by conifers.

Aspen occurs as a major seral species in the following coniferous forest series within the Intermountain Region: *Picea engelmannii, Abies lasiocarpa, Pseudotsuga menziesii, Abies concolor, Picea pungens,* and *Pinus ponderosa* (Mauk and Henderson 1984; Steele and others 1981, 1983; Youngblood and Mauk 1985). In addition, aspen is a minor seral tree in the *Pinus albicaulis* series (Steele and others 1983) and *Pinus flexilis* series (Youngblood and Mauk 1985). As a seral species, it may dominate the forest community for many decades following severe disturbance, such as fire or clearcutting, but will gradually decline as the conifers become reestablished. In relatively rare cases, aspen may persist as a self-perpetuating minor component of the climax conifer overstory.

Aspen forests are stable or climax communities not only in the Intermountain Region (Mueggler and Campbell 1982, 1986; Youngblood and Mueggler 1981) but also in Montana (Lynch 1955), southeastern Wyoming (Alexander and others 1986; Wirsing and Alexander 1975), North Dakota (Hansen and others 1984), South Dakota (Hoffman and Alexander 1987; Severson and Thilenius 1976), and Colorado (Hess and Alexander 1986; Hoffman and Alexander 1980; Johnston and Hendzel 1985; Langenheim 1962). The environmental conditions determining aspen's role as a seral or as a climax tree species remain ill-defined. This flexibility in successional status, especially the ability to function as a major seral tree in a wide variety of coniferous forest series, contributes greatly to the diversity of overstory and undergrowth composition that exists in aspen forests in the Intermountain Region. Composition of these seral aspen communities changes over time as the community progresses in the course of normal succession toward dominance by conifers. As conifers gain dominance less light penetrates to the forest floor, and undergrowth shrubs and herbs decrease in both variety and abundance.

Grazing

Grazing has also contributed to the variability of the Region's aspen forests. Settlement during the middle and latter part of the 19th century depended heavily upon the livestock industry. The lush undergrowth of aspen forests was considered excellent summer range. Over a century of grazing—frequently intense in the late 1800's and early 1900's, and by different classes of livestock as well as occasionally by wild ungulates—left its mark in both pronounced and ill-defined alterations in species composition and production.

Aspen Genotypes

Aspen's usual vegetative mode of reproduction results in clones within which the individual trees are genetically identical. However, there exist striking, genetically caused differences between clones in physical appearance, resistance to disease, and, in all probability, response to human perturbations (Barnes 1975; Jones and DeByle 1985c). Differences probably exist in the adaptability of different genotypes to particular environmental situations, but this has yet to be demonstrated quantitatively. Although the genotype of a specific aspen clone is unlikely to directly affect the undergrowth vegetation within the clone, it likely will have an effect on the potential of the clone to produce wood fiber.

Community Variability

Thus, environment, succession, grazing, and genetics have all contributed to the variability encountered today in the aspen forests of the Region. This variability is expressed by differences in the structure of plant communities as well as by differences in their species composition. Most aspen stands have an even-aged canopy because of rapid regeneration by suckering following a major disturbance such as fire. However, uneven-aged stands form when an aspen overstory slowly disintegrates because of disease or age and is gradually replaced by growth of released suckers. Most aspen communities are multilayered. Sufficient light is able to penetrate the aspen-dominated overstory to support an abundance of undergrowth, especially in comparison to the usual paucity of herbs and shrubs in adjacent coniferous forests. Community structure can be simple or complex. For example, the tree layer may consist of either pure aspen (a deciduous, broad-leaved tree) or a mixture of aspen with evergreen conifers ascending into the canopy. The undergrowth is frequently a multilayered assemblage of shrubs, perennial herbs, and annuals. The shrub stratum itself may consist of an intermittent tall shrub layer 6 to 12 ft (1.8 to 3.7 m) high and a low shrub layer 3 to 4 ft (0.9 to 1.2 m) high, whereas the herb layer may consist of a mixture of life forms—tall forbs, low forbs, grasses, and sedges. The most complex structure contains all of these layers. The simplest consists of a pure, even-aged aspen canopy underlain by a simple assemblage of graminoids.

Among the hundreds of plant species present in the aspen forests of the Intermountain Region (over 550 encountered in this study alone), surprisingly few can be considered characteristic of the aspen type. The assemblage of species in the undergrowth varies greatly from place to place. Only four species (*Symphoricarpos oreophilus, Agropyron trachycaulum, Achillea millefolium,* and *Thalictrum fendleri*) occurred in more than half of the over 2,100 aspen stands sampled in the Region (see section, "Aspen Community Characteristics"). Using the criteria of at least 25 percent constancy (that is, occurring in a fourth of all stands) and at least 5 percent average canopy cover in stands where the species occurs to indicate a "characterizing" species, only 12 met these conditions. Three were shrubs (*S. oreophilus, Amelanchier* *alnifolia, Berberis repens*), four were grasses (*Bromus carinatus, Elymus glaucus, Stipa occidentalis, Poa pratensis*), and five were forbs (*Thalictrum fendleri, Osmorhiza chilensis, Geranium viscosissimum, Valeriana occidentalis,* and *Lupinus argenteus*). In a separate analysis (Mueggler 1985a), I determined that *S. oreophilus* and *T. fendleri* are the only characterizing species common to the Central and Southern Rocky Mountain, Colorado Plateau, and Basin and Range Provinces of the interior West. Obviously then, the broad environmental amplitude of aspen accommodates many undergrowth combinations consisting of assemblages of species with relatively restrictive environmental requirements.

APPROACH

The primary purpose of this effort was to develop a framework that would sensibly partition the extant variability of the aspen communities in the Intermountain Region. The goal was a classification system to facilitate resource management. The effort was based upon two assumptions. The first is that major differences in vegetation composition reflect meaningful differences in environment, successional stage, grazing history, or combinations of these influences. The second assumption is that these differences in community composition are indicative of probable differences in resource values and responses to manipulatory management.

In addition to the development of a classification, an attempt was made to obtain as much information as time allowed on resource productivity levels of the various communities. The study was not designed to develop recommendations for the management of the different communities. Instead, the classification should serve as a mapping tool and provide the organizational framework to which management experience and the results of management studies can be attached. (Appendixes A through M give readers further details on the study.)

A community type approach to classification development was chosen in preference to a habitat type approach because of the ill-defined successional status of communities within the overall aspen ecosystem. The habitat type approach relies upon the ability to recognize the potential or climax vegetation of a given environmental situation—an approach that is fraught with uncertainty in aspen communities. Community types, however, are aggregations of similar plant communities based upon existing floristics regardless of successional status. As with habitat types, community types are based upon the premise that the vegetation is an environmental integrator and thus reflects major environmental differences. In contrast to habitat types, however, the existing vegetation also reflects the effects of past disturbances. Therefore, community types may represent either climax plant associations or successional communities within a sere. Community types are what the manager actually sees in the field. Once community types are defined, effort can be directed toward establishing successional relationships and linking the community types to known or expected climax plant associations (placing them within habitat types). Meanwhile, the community types can be used as a basis for mapping, structuring information, and resource management planning.

The need to incorporate successional status in the classification breakdown was recognized from the outset. Aspen's dominant seral role in a variety of coniferous forest habitat types was of immediate concern. Separation criteria for recognizing these naturally seral situations were required. These communities were subsequently placed in separate aspen-conifer overstory cover types. Impacts of intense past grazing on community composition became apparent as field study progressed and suggested the probable existence of long-term grazing disclimax situations. In most cases, however, grazing-induced changes in composition were more subtle and, though highly probable, were difficult to evaluate. Existence of communities that represented climax or near-climax composition could only be inferred from previous knowledge of species grazing preference and probable response to use. The extreme stocking at the turn of the century virtually assured grazing on all accessible sites, and few aspen forests in the Region exist on areas protected by physiographic barriers. Consequently, "benchmark" areas of known climax composition were not available to establish reliable indicators for climax or near-climax aspen communities.

During the study it became apparent that recognition of differences in vegetation structure would enhance the usefulness of the classification. The presence or absence of conifers in the overstory, and the presence or absence of tall and low shrubs in the undergrowth, are particularly relevant to the value of aspen communities as wildlife habitat. Such structural differences also tend to reflect environmental differences and can have a pronounced influence on the herbaceous undergrowth. Therefore, vegetation structure was incorporated early into the classification breakdown.

Indicator species for the various structural layers were selected on the basis of constancy and cover within a layer and on perceived sensitivity to major differences in abiotic environment. Guilds of species such as tall forbs were used when necessary to avoid what appeared to be unwarranted splitting of types based solely upon differential abundance of individual species with similar ecological requirements. Separation of obvious grazing disclimax situations was a final consideration in forming the classification. Figure 3 illustrates the flow of considerations in development of the classification.

Work on this study progressed in phases over 8 years. Formal work began with data collection, analyses, and a preliminary classification developed for western Wyoming (Youngblood and Mueggler 1981). This was followed by a description of aspen community types in southeastern Idaho (Mueggler and Campbell 1982) and in Utah (Mueggler and Campbell 1986). Data were then gathered for the aspen communities on the Humboldt and Toiyabe National Forests in Nevada during the summer of 1984 and subsequently analyzed but not published. Stand

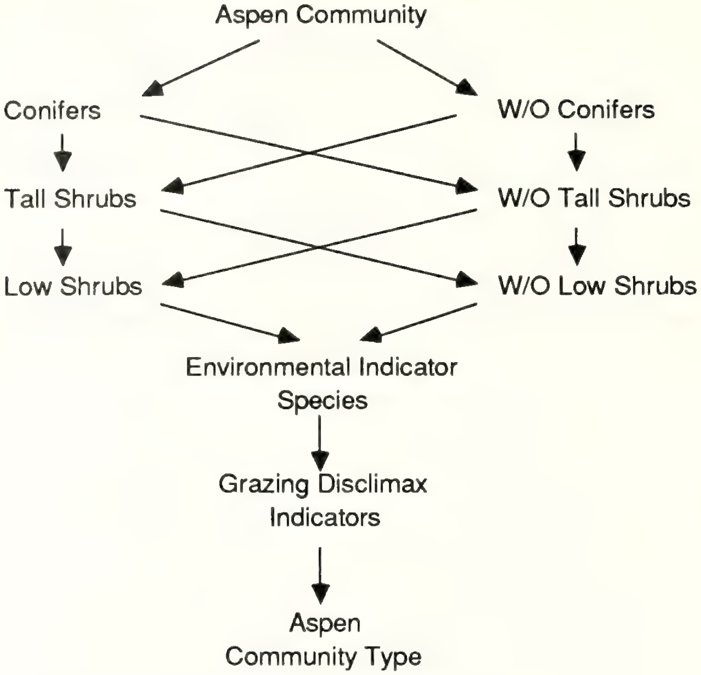

Figure 3—Flow of considerations in development of the classification.

composition data furnished by cooperators studying aspen-to-conifer succession were incorporated in the overall data set when these data were considered reliable and in suitable form. Less than 10 percent of the data base was obtained from these cooperators.

The reports on portions of the Region were developed independently rather than by progressive extension of the classification from one area into the next. This procedure profoundly affected subsequent changes in type names as well as differences in the formation of community types. Concepts of the importance of vegetation structure and the indicator value of certain plant species to the development of the classification evolved as understanding of community variability and succession improved with experience. Analysis of the composite data-set for the entire Region, incorporating this improved understanding, was therefore desirable to enable the development of a unified classification of aspen community types for the whole Intermountain Region. This publication, therefore, supersedes the independent classifications. The linkage between type names assigned in those preliminary, partial classifications and this comprehensive Regional classification is shown in appendix D. Aspen communities in the western and central Idaho portions of the Region, as well as those in extreme western Nevada, were not sampled. This document is, however, based on data from the remainder of the Intermountain Region (fig. 4) where the bulk of the aspen woodlands occurs.

Details of field sampling procedures are described in appendix A. Briefly, the need for a large number of sampled stands to evaluate type variability and upon which to base the classification, plus the desire to obtain the quantitative data needed to describe productivity factors, dictated the use of two types of sample plots. Reconnaissance plots helped in obtaining the large volumes of species composition data based upon canopy cover estimates. Intensive plots were designed to yield data on stand structure, age, productivity, and environment, as well as upon species composition. Only two criteria were used in selecting a stand for sampling: at least 50 percent of the tree canopy had to be aspen, and the stand needed to be large enough to accommodate a single $^{1}/_{13}$-acre ($^{1}/_{32}$ -ha) macroplot within an approximately uniform environment. Although stand selection was subjective, preconceived biases that could affect the resulting classification were avoided. Data were acquired for 2,137 aspen stands in the Intermountain Region area. Approximately a fourth of these were intensively sampled.

Taxonomic uncertainties, species similarities, and certain nomenclature ambiguities necessitated combinations of some species under a single name; the details of these combinations are discussed in appendix A. Species listed in the community type composition tables (table 2; appendix F) that are followed by a "+" are those names representing more than a single taxon. The following species combinations were used in the determination of community types, in the text, and in all tabular summaries:

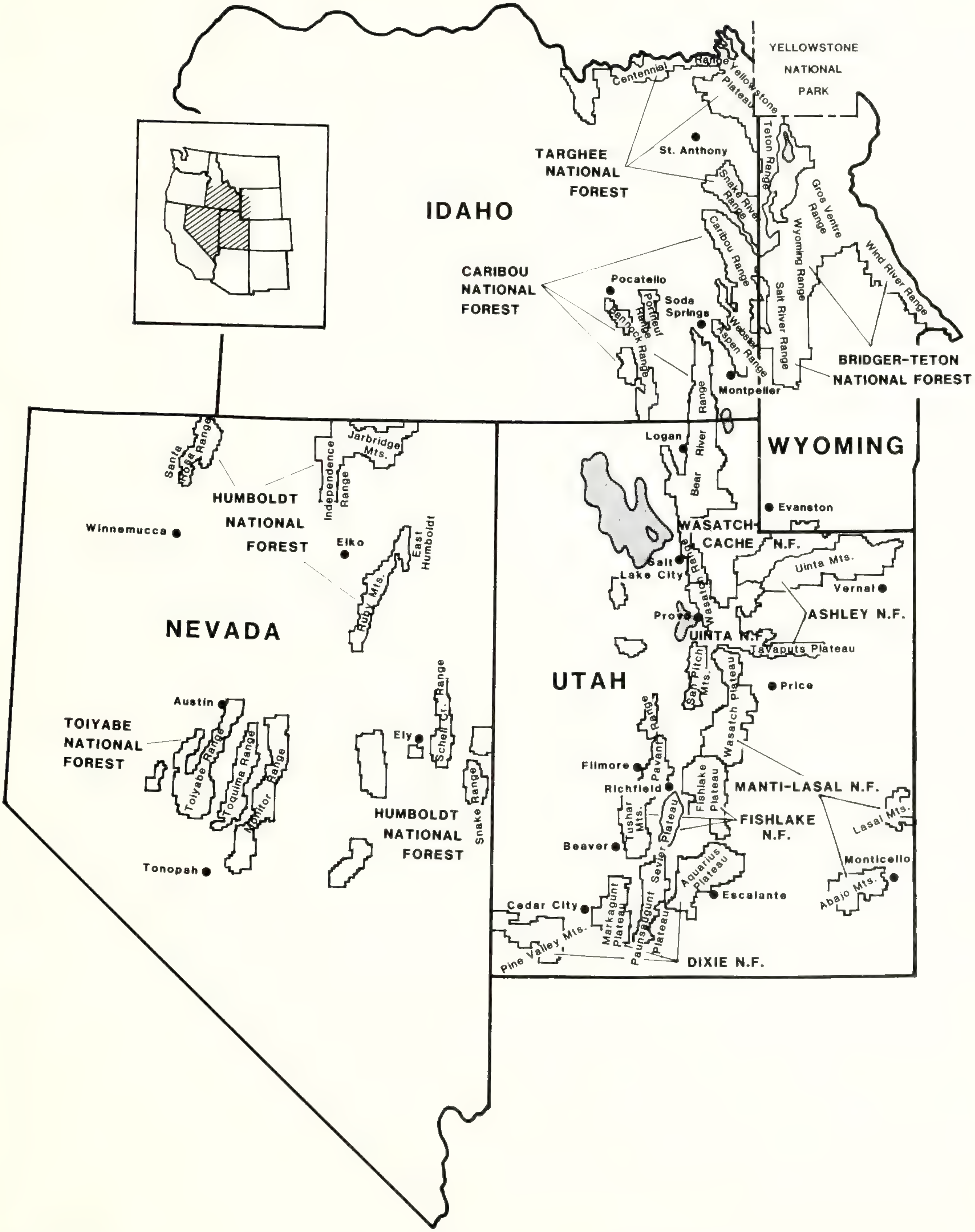

Figure 4—Area of the Intermountain Region covered by this classification of aspen community types.

Name used:	**Includes:**
Rosa woodsii	*Rosa nutkana*
Sambucus racemosa	*Sambucus cerulea*
Agropyron trachycaulum	*Agropyron subsecundum,* *Agropyron caninum*
Bromus carinatus	*Bromus marginatus,* *Bromus polyanthus*
Festuca idahoensis	*Festuca ovina*
Koeleria cristata	*Koeleria nitida*
Stipa occidentalis	*Stipa columbiana,* *Stipa nelsonii*
Delphinium occidentale	*Delphinium barbeyi*
Fragaria vesca	*Fragaria virginiana*
Geranium viscosissimum	*Geranium fremontii*
Mertensia arizonica	*Mertensia ciliata,* *Mertensia franciscana*
Osmorhiza chilensis	*Osmorhiza depauperata*
Polemonium foliosissimum	*Polemonium occidentale*
Senecio serra	*Senecio triangularis*
Thalictrum fendleri	*Thalictrum occidentale*

Analytical procedures used to form relatively homogeneous groups of stands representing community types consisted primarily of comparisons of species composition by the use of synthesis or association tables (Mueller-Dombois and Ellenberg 1974). The canopy cover estimates of individual species in each stand formed the basic data for these comparisons. In addition to species composition, emphasis was placed on similarities in vegetation structure and on the constancy and fidelity (restriction to the group) of species within possible groups. Numerous reiterations of computer-formed stand alignments permitted the sequencing of stands according to similarities of what were considered to be important vegetation characteristics. Following determination of what appeared to be sensible groups (community types), a dichotomous key was prepared to facilitate field use of the classification. The key was checked against all stands used to form the groups and then was validated by use on an additional set of stands initially withheld from the data base used to form the classification. Of all stands, 6 percent could not be accommodated by the key or classification. These stands are believed to represent either unusual isolated communities or ill-defined types representing unusual environmental or disturbance situations.

Summary data were then prepared showing by aspen community type the following factors: species constancy and average cover (appendix F); production and growth estimates for aspen (appendixes I and J); undergrowth production (appendix L) and forage suitability (appendix K); and the distribution of community types by the National Forests within the Intermountain Region (appendix C). Appendix A discusses the analytical procedures followed in developing the classification and productivity information.

ASPEN COMMUNITY CHARACTERISTICS

The general characteristics of aspen-dominated forests within the Intermountain Region were examined in terms of community composition, community structure, and productivity of both the overstory and the undergrowth.

Variability in Community Composition

These forests perhaps are best characterized by variability in both species composition and vegetation structure. Over 550 plant species were found associated with aspen in this study. Few of these occurred in a substantial proportion of the stands (that is, had high constancy). For example, only four occurred in at least half of the 2,137 stands evaluated, 21 in at least a quarter, and 65 in at least 10 percent of the stands (table 2). This generally low overall constancy is attributable to the broad environmental adaptability of aspen compared to its associates. These most common associated species include representation from all of the major vegetation classes. However, a greater variety of forbs are usually present than graminoid, shrub, or tree life forms. They also include species associated with obviously different environments. For example, *Artemisia tridentata, Carex rossii, Bromus anomalus,* and *Lupinus argenteus* often occur in relatively dry situations compared to *Abies lasiocarpa, Aquilegia coerulea, Delphinium occidentale,* and *Senecio serra.* And some species are generally susceptible to excessive grazing and browsing (such as *Amelanchier alnifolia, Prunus virginiana, Sambucus* spp., *Heracleum lanatum, Osmorhiza occidentalis, Castilleja miniata),* whereas others usually increase under heavy grazing (such as *Juniperus communis, Poa pratensis, Taraxacum officinale, Rudbeckia occidentalis, Astragalus miser,* and *Nemophila breviflora*).

The challenge of developing a useful classification for these highly variable aspen forests lies in recognition of common patterns in what appears to be an unlimited number of possible species combinations. The number of combinations are virtually limitless because no two naturally occurring plant communities are identical. These combinations of species not only reflect environmental and successional gradients but are also frequently influenced by the chance proximity of propagules. Thus, a classification unit must be defined from a perceived level of commonality within a group of individual stands that differ from one another. Seldom if ever can these communities be readily sorted into neat, clearcut taxonomic units. Developing a classification becomes a matter of judging the amount of structural and compositional variability tolerable in defining the taxonomic units. The amount of variability acceptable should be determined by the need for, and the projected use of, the classification.

Similarity of life form and perceived similarities in environmental adaptability of some species enabled recognition of certain species groups or guilds. This was useful for structuring the classification system, for then the presence of one or more guild members could serve equally as a community type indicator. Foremost among the recognizable guilds are the tall forbs. This group of species is an indicator of a major undergrowth type that occurs under various combinations of shrub and tree strata. Nine forb species are included in the tall forb guild: *Agastache urticifolia, Aster engelmannii, Delphinium occidentale, Hackelia floribunda, Heracleum*

Table 2—Most commonly encountered species (10 percent or greater constancy) in the aspen types of the Intermountain Region. Species are arranged by synusia and by constancy of occurrence

Species	Constancy (cover)[1]	
Trees		
Populus tremuloides	100	(69)
Abies lasiocarpa	29	(10)
Pseudotsuga menziesii	19	(5)
Pinus contorta	12	(9)
Picea engelmannii	10	(6)
Pinus flexilis	10	(2)
Shrubs		
Symphoricarpos oreophilus	73	(15)
Rosa woodsii +	40	(3)
Berberis repens	37	(6)
Amelanchier alnifolia	34	(7)
Prunus virginiana	22	(13)
Juniperus communis	16	(19)
Pachystima myrsinites	14	(10)
Artemisia tridentata	10	(4)
Graminoids		
Agropyron trachycaulum +	51	(4)
Bromus carinatus +	46	(8)
Elymus glaucus	37	(10)
Poa pratensis	34	(15)
Stipa occidentalis +	25	(6)
Melica spectabilis	17	(2)
Poa nervosa	17	(4)
Carex hoodii	16	(3)
Calamagrostis rubescens	15	(33)
Carex geyeri	15	(16)
Carex rossii	15	(4)
Bromus ciliatus	11	(3)
Forbs		
Achillea millefolium	56	(2)
Thalictrum fendleri +	54	(10)
Taraxacum officinale	49	(3)
Geranium viscosissimum +	45	(7)
Osmorhiza chilensis +	44	(5)
Forbs (Con.)		
Stellaria jamesiana	35	(2)
Lupinus argenteus	30	(7)
Agastache urticifolia	27	(4)
Valeriana occidentalis	25	(5)
Hackelia floribunda	25	(3)
Senecio serra +	24	(4)
Fragaria vesca +	24	(3)
Rudbeckia occidentalis	23	(10)
Osmorhiza occidentalis	19	(7)
Aster engelmannii	18	(3)
Smilacina stellata	18	(3)
Galium boreale	17	(2)
Potentilla glandulosa	17	(1)
Lathyrus lanszwertii	16	(16)
Vicia americana	16	(6)
Frasera speciosa	14	(1)
Potentilla gracilis	14	(1)
Astragalus miser	13	(10)
Mertensia arizonica +	13	(8)
Erigeron speciosus	13	(2)
Viola nuttallii	13	(2)
Arnica cordifolia	12	(8)
Delphinium occidentale +	12	(3)
Epilobium angustifolium	12	(3)
Hydrophyllum capitatum	12	(1)
Castilleja miniata	11	(1)
Aquilegia coerulea	10	(1)
Perideridia gardneri	10	(1)
Viola adunca	10	(1)
Annuals		
Descurainia richardsonii	20	(1)
Nemophila breviflora	18	(17)
Galium bifolium	15	(5)
Polygonum douglasii	13	(4)
Collomia linearis	11	(2)

[1] Average canopy cover for those stands in which the species occurs.

lanatum, Mertensia arizonica, Osmorhiza occidentalis, Senecio serra, and *Valeriana occidentalis.* Various combinations of these species frequently occur together. Seldom does one member alone dominate the undergrowth. Although the environmental amplitude of each undoubtedly differs, enough similarity exists to warrant grouping for purposes of this classification.

Other guilds recognized and used in the development of the classification include combinations of shrubs and combinations of graminoids, as well as combinations of other forbs. *Amelanchier alnifolia* and *Prunus virginiana* constitute a tall shrub guild; these species frequently occur together, and no discernible difference could be detected in their environmental requirements. In contrast, the graminoids *Calamagrostis rubescens* and *Carex geyeri* are treated as a guild even though they do not often occur together because of geographical separation; they do, however, appear to occupy similar environmental niches and have somewhat similar growth forms. The comparatively common low forb species *Thalictrum fendleri, Osmorhiza chilensis,* and *Geranium viscosissimum* are viewed as a guild because of lack of apparent environmental separation. Finally, the upright grasses *Bromus carinatus, Elymus glaucus,* and *Agropyron trachycaulum* are generally treated as a group because of their life form, similar environmental requirements, and apparently similar behavior under grazing.

Variation Within Strata

As mentioned previously, vegetation structure was an important element considered in development of the classification. Composition of the tree stratum, tall and low shrub strata, and the herb stratum were considered individually. Some communities contained all four strata. Others would lack tall shrubs, low shrubs, or both. Generalized composition similarities within a given stratum (indicated by a given epithet species or guild) tend to be repeated under different higher level strata. For example, an herbaceous stratum identified by the tall forb epithet can be found under various tree cover types and with or without tall and low shrub strata.

A further generalization of aspen forests within the Intermountain Region can be conveyed by examining the proportion of stands that have similar composition within each vegetation stratum (table 3). The most commonly encountered tree cover type was one consisting of aspen with less than 10 percent cover of a single conifer species. *Abies lasiocarpa* was the most common conifer associated with aspen in the tree layer; this combination formed the *Populus tremuloides—A. lasiocarpa* cover type in almost 12 percent of the stands sampled. A wide variety of other mixed aspen-conifer cover types occurred but were not nearly as common.

A tall shrub stratum occurred in only about a fifth of the stands sampled in the Region (table 3). This stratum was usually characterized by *Amelanchier alnifolia* or *Prunus virginiana*, or both; *A. alnifolia* was used as the epithet in the type names. In a few instances, *Salix scouleriana* was an abundant tall shrub that was used as the epithet.

Half of the aspen stands in the Region contained a conspicuous layer of low shrubs. Usually *Symphoricarpos oreophilus* was the conspicuous element in this stratum and consequently was used as the epithet. *Juniperus communis* was the next most abundant and characterizing shrub and was used as an epithet in about 5 percent of the aspen communities. Several other low shrubs characterized different environmental situations and were used as epithet species, but they were relatively uncommon.

The herbaceous stratum of aspen communities in the Region was most often characterized by members of the tall forb group. Almost a third of the communities sampled contained this type of undergrowth and carried the tall forb epithet in the community type name. About 14 percent of the communities were characterized by a low forb complex in which *Thalictrum fendleri* was usually the most constantly occurring species and therefore used as the epithet. Almost equally abundant were communities in which the graminoids *Calamagrostis rubescens* or *Carex geyeri* or both tended to dominate the herbaceous undergrowth. Frequently, these communities did not contain a great diversity of other undergrowth species. Usually, the epithet *C. rubescens* was used. However, where only *C. geyeri* occurred in a community type, it was used as the epithet. *Bromus carinatus* (along with its guild associates *Elymus glaucus* and *Agropyron trachycaulum*) was considered a characterizing species in approximately 9 percent of the communities and the sedge *Carex rossii* the epithetic species in 6 percent. Eight other species characterized different herbaceous undergrowth conditions, but their occurrence was relatively infrequent (table 3).

Table 3—Epithet species or guilds by vegetation structure classes used in the classification of aspen forests in the Intermountain Region, and the proportion of stands in the Region typified by each

Strata and epithet	Percent of stands
Tree stratum:	
Populus tremuloides	78.4
P. tremuloides—Abies lasiocarpa	11.5
P. tremuloides—Pinus contorta	3.0
P. tremuloides—Pseudotsuga menziesii	2.6
P. tremuloides—Abies concolor	2.5
P. tremuloides—Pinus ponderosa	.9
P. tremuloides—Picea pungens	.7
P. tremuloides—Pinus flexilis	.4
Tall shrub stratum:	
(none)	83.3
Amelanchier alnifolia	16.1
Salix scouleriana	.6
Low shrub stratum:	
(none)	49.5
Symphoricarpos oreophilus	41.6
Juniperus communis	5.3
Artemisia tridentata	1.3
Shepherdia canadensis	1.1
Sambucus racemosa	.6
Arctostaphylos patula	.4
Rubus parviflorus	.2
Herb stratum:	
Tall Forb	31.8
Thalictrum fendleri	14.3
(none)	13.4
Calamagrostis rubsecens	12.6
Bromus carinatus	8.7
Carex rossii	6.0
Poa pratensis	3.4
Carex geyeri	2.6
Wyethia amplexicaulis	1.8
Festuca thurberi	1.2
Astragalus miser	1.2
Pteridium aquilinum	1.1
Stipa comata	.8
Lupinus argenteus	.7
Veratrum californicum	.4

Production Variability

The amount of variation encountered in stand structure and composition is exemplified by the variation in productivity of aspen forests within the Intermountain Region (appendix G). The basal area of aspen trees ranged from 14 to 342 ft^2/acre (3.3 to 78.4 m^2/ha) and averaged 138 ft^2/acre (31.7 m^2/ha). Estimated total volume growth of aspen per year ranged from 4 to 76 ft^3/acre (0.3 to 5.3 m^3/ha) and averaged 38 ft^3/acre (2.7 m^3/ha). This extreme variability in wood production is again evidence of aspen's ability to dominate, even though temporarily, sites of widely differing quality.

Total annual dry weight of undergrowth herbage varied from a low of less than 10 lb/acre (11 kg/ha) to 3,800 lb/acre (4,260 kg/ha). The average production for all sampled stands in the Region was 976 lb/acre (1,094 kg/ha). Production by vegetation classes differed greatly from stand to stand but overall averaged approximately 14 percent shrubs, 30 percent graminoids, 53 percent forbs, and 3 percent annuals. In many stands a shrub component was either absent or less than 1 percent. In other stands, those that were severely overgrazed for extended periods, the amount of perennial forbs was generally reduced and the proportion of annuals or graminoids increased. Seral aspen stands in advanced stages of succession to conifers usually contained much less undergrowth production than did the stable stands. As a general rule, production of herbaceous and shrubby undergrowth gradually decreased as conifer cover increased in the overstory layer. This decrease usually became pronounced when conifers were as little as 15 percent of the overstory basal area (Mueggler 1985b).

The undergrowth of the Region's aspen communities usually ranks as fairly high-quality livestock forage. The proportion of production in the "desirable" suitability class ranged between community types from a low of 23 percent to a high of 76 percent and averaged 59 percent (as judged by USDA Forest Service 1981). Undergrowth considered as "least desirable" quality ranged from a low of 1 percent to a high of 51 percent, and averaged only 9 percent of the total undergrowth production. On the average, 32 percent of the undergrowth was considered of "intermediate" quality.

THE CLASSIFICATION

This classification partitions those forests in the Intermountain Region where aspen is at least 50 percent of the tree canopy into eight cover types based on the dominant and codominant trees in the stand. These cover types are then broken into 56 aspen community types based on common indicator species, or species guilds, in the undergrowth. Table 4 provides a listing of these cover types and the community types within each. The *Populus tremuloides* cover type is the most diverse and contains well over half the total community types. For convenience, this cover type was further divided into three undergrowth types based on undergrowth structure: the herb undergrowth type consists of communities without a definite shrub stratum; the low shrub type consists of communities with a low shrub component but without a tall shrub stratum; and the tall shrub type contains those communities with a tall shrub component but may or may not have a low shrub stratum.

The seven mixed aspen-conifer cover types are partitioned into relatively few community types. The most diverse of these cover types is that where *Abies lasiocarpa* shares the overstory with aspen; 10 community types occur within this cover type. Three cover types are recognized that were not further partitioned into distinct community types: those where aspen shared the tree stratum with either *Picea pungens, Pinus flexilis,* or *Pinus ponderosa.*

Although a large number of separate community types were identified and named, comparatively few of these are used to classify the bulk of the aspen communities encountered in the Region. Only 14 community types are required to classify almost two-thirds of the stands. Four-fifths of the stands fall into only 26 community types. Thus, over half of the community types identified, although considered distinct entities, are seldom encountered. The 59 aspen types were therefore grouped into three categories according to their sampled abundance within the Region (table 5). Those considered to be "major" community types (14 in all) are those described on the basis of at least 40 stands in each. These form the bulk of the aspen stands within the Region. The "minor" community types are those that were described on the basis of 20 to 40 stands in each type. And the "incidental" types are those that were described on the basis of less than 20 stands in each type. Some of the latter types were described by only four to seven stands but were distinctly unique. In contrast, the most common type, the *Populus tremuloides*/Tall Forb community type, was described on the basis of 228 stands. The incidental community types are seldom seen in the Region as a whole, although some may be more frequent in some areas than in others. The distribution of the individual community types is discussed under the type descriptions.

Some of the community types are obviously successional to coniferous forests. Others appear to represent situations where intense and prolonged past grazing has had a major effect on composition of the undergrowth. Although the climax status of a good portion of the types is uncertain, many appear to be relatively stable and are so identified. In some instances, they may approximate actual climax community types and thus represent habitat types. In others, they may represent situations that will eventually succeed to coniferous forest even though little evidence exists at present to verify this possibility. In most cases, these types probably have been altered by grazing but are still basically reflecting abiotic environmental influences. Table 5 includes a breakdown of the types by their perceived successional status.

Use of Vegetation Key

The key to the community types (see next section) first places the community to be classified into its proper cover type. This is dependent upon a judgment of the amounts of various conifer species present in the tree stratum. The canopy cover estimate of the conifer species should include that of reproduction as well as that of the amount in the overstory. Different conifer species are given sequential consideration primarily on the basis of their susceptibility to moisture stress. Those species that require the less stressful moist sites are broken out first, and those able to occupy the driest sites last. The minimum amount of cover of a single conifer species necessary to define a specific aspen-conifer cover type is set at 10 percent. This amount was subjectively judged to be more than accidental and to approximate the level required for a conifer species to validly indicate site differences and successional trends to conifer dominance.

For convenience, the *Populus tremuloides* cover type, which contains 35 community types, is further subdivided into undergrowth categories. Those communities possessing critical amounts of selected tall shrub species are placed in a tall shrub category. Those that do not meet this criterion but have a distinct layer of low shrub species are placed in the low shrub category. Communities that lack a well-defined component of shrubs are placed within the herb undergrowth category.

Table 4—Aspen community types within the Intermountain Region by overstory cover types

Cover type and community type	Abbreviation
***Populus tremuloides* cover type:**	
Herb undergrowth types	
P. tremuloides/Veratrum californicum	POTR/VECA
P. tremuloides/Pteridium aquilinum	POTR/PTAQ
P. tremuloides/Wyethia amplexicaulis	POTR/WYAM
P. tremuloides/Festuca thurberi	POTR/FETH
*P. tremuloides/*Tall Forb	POTR/TALL FORB
P. tremuloides/Calamagrostis rubescens	POTR/CARU
P. tremuloides/Thalictrum fendleri	POTR/THFE
P. tremuloides/Bromus carinatus	POTR/BRCA
P. tremuloides/Carex rossii	POTR/CARO
P. tremuloides/Stipa comata	POTR/STCO
P. tremuloides/Astragalus miser	POTR/ASMI
P. tremuloides/Poa pratensis	POTR/POPR
Low shrub undergrowth types	
P. tremuloides/Rubus parviflorus	POTR/RUPA
P. tremuloides/Sambucus racemosa	POTR/SARA
P. tremuloides/Shepherdia canadensis	POTR/SHCA
*P. tremuloides/Symphoricarpos oreophilus/*Tall Forb	POTR/SYOR/TALL FORB
P. tremuloides/S. oreophilus/Calamagrostis rubescens	POTR/SYOR/CARU
P. tremuloides/S. oreophilus/Thalictrum fendleri	POTR/SYOR/THFE
P. tremuloides/S. oreophilus/Festuca thurberi	POTR/SYOR/FETH
P. tremuloides/S. oreophilus/Carex rossii	POTR/SYOR/CARO
P. tremuloides/S. oreophilus/Wyethia amplexicaulis	POTR/SYOR/WYAM
P. tremuloides/S. oreophilus/Bromus carinatus	POTR/SYOR/BRCA
P. tremuloides/S. oreophilus/Poa pratensis	POTR/SYOR/POPR
P. tremuloides/Juniperus communis/Carex geyeri	POTR/JUCO/CAGE
P. tremuloides/J. communis/Lupinus argenteus	POTR/JUCO/LUAR
P. tremuloides/J. communis/Astragalus miser	POTR/JUCO/ASMI
P. tremuloides/Artemisia tridentata	POTR/ARTR
Tall shrub undergrowth types	
P. tremuloides/Salix scouleriana	POTR/SASC
*P. tremuloides/Amelanchier alnifolia—Symphoricarpos oreophilus/*Tall Forb	POTR/AMAL-SYOR/TALL FORB
P. tremuloides/A. alnifolia—S. oreophilus/Thalictrum fendleri	POTR/AMAL-SYOR/THFE
P. tremuloides/A. alnifolia—S. oreophilus/Calamagrostis rubescens	POTR/AMAL-SYOR/CARU
P. tremuloides/A. alnifolia—S. oreophilus/Bromus carinatus	POTR/AMAL-SYOR/BRCA
P. tremuloides/A. alnifolia/Pteridium aquilinum	POTR/AMAL/PTAQ
*P. tremuloides/A. alnifolia/*Tall Forb	POTR/AMAL/TALL FORB
P. tremuloides/A. alnifolia/Thalictrum fendleri	POTR/AMAL/THFE
***Populus tremuloides—Abies lasiocarpa* cover type:**	
*P. tremuloides—A. lasiocarpa/*Tall Forb	POTR-ABLA/TALL FORB
P. tremuloides—A. lasiocarpa/Thalictrum fendleri	POTR-ABLA/THFE
P. tremuloides—A. lasiocarpa/Carex geyeri	POTR-ABLA/CAGE
P. tremuloides—A. lasiocarpa/Carex rossii	POTR-ABLA/CARO
P. tremuloides—A. lasiocarpa/Shepherdia canadensis	POTR-ABLA/SHCA
*P. tremuloides—A. lasiocarpa/Symphoricarpos oreophilus/*Tall Forb	POTR-ABLA/SYOR/TALL FORB
P. tremuloides—A. lasiocarpa/S. oreophilus/Thalictrum fendleri	POTR-ABLA/SYOR/THFE
P. tremuloides—A. lasiocarpa/S. oreophilus/Bromus carinatus	POTR-ABLA/SYOR/BRCA
P. tremuloides—A. lasiocarpa/Juniperus communis	POTR-ABLA/JUCO
P. tremuloides—A. lasiocarpa/Amelanchier alnifolia	POTR-ABLA/AMAL
***Populus tremuloides—Pinus contorta* cover type:**	
P. tremuloides—P. contorta/Thalictrum fendleri	POTR-PICO/THFE
P. tremuloides—P. contorta/Carex geyeri	POTR-PICO/CAGE
P. tremuloides—P. contorta/Symphoricarpos oreophilus	POTR-PICO/SYOR
P. tremuloides—P. contorta/Juniperus communis	POTR-PICO/JUCO
***Populus tremuloides—Pseudotsuga menziesii* cover type:**	
P. tremuloides—P. menziesii/Calamagrostis rubescens	POTR-PSME/CARU
P. tremuloides—P. menziesii/Symphoricarpos oreophilus	POTR-PSME/SYOR
P. tremuloides—P. menziesii/Juniperus communis	POTR-PSME/JUCO
P. tremuloides—P. menziesii/Amelanchier alnifolia	POTR-PSME/AMAL

(con.)

Table 4 (Con.)

Cover type and community type	Abbreviation
***Populus tremuloides—Abies concolor* cover type:**	
P. tremuloides—A. concolor/Poa pratensis	POTR-ABCO/POPR
P. tremuloides—A. concolor/Symphoricarpos oreophilus	POTR-ABCO/SYOR
P. tremuloides—A. concolor/Arctostaphylos patula	POTR-ABCO/ARPA
***Populus tremuloides—Picea pungens* cover type.**	POTR-PIPU
***Populus tremuloides—Pinus flexilis* cover type.**	POTR-PIFL
***Populus tremuloides—Pinus ponderosa* cover type.**	POTR-PIPO

Table 5—Aspen community types within the Intermountain Region by categories of relative abundance (determined by proportions of sampled stands) and general successional status

Stable types	Seral to conifers	Grazing disclimax
Major aspen types (Estimated 64 percent of Intermountain Region aspen stands):		
POTR/TALLFORB	POTR-ABLA/TALLFORB	POTR/BRCA
POTR/CARU	POTR-ABLA/CARO	POTR/SYOR/BRCA
POTR/THFE		
POTR/CARO		
POTR/SYOR/TALLFORB		
POTR/SYOR/CARU		
POTR/SYOR/THFE		
POTR/AMAL-SYOR/TALL FORB		
POTR/AMAL-SYOR/THFE		
POTR/AMAL-SYOR/CARU		
Minor aspen types (Estimated 16 percent of Intermountain Region aspen stands):		
POTR/WYAM	POTR-ABLA/SYOR/TALLFORB	POTR/POPR
POTR/JUCO/CAGE	POTR-ABLA/THFE	POTR/SYOR/POPR
POTR/ARTR	POTR-PICO/JUCO	POTR/AMAL-SYOR/BRCA
POTR/AMAL/THFE	POTR-ABCO/SYOR	
POTR/AMAL/TALL FORB		
Incidental aspen types (Estimated 20 percent of Intermountain Region aspen stands):		
POTR/VECA	POTR-ABLA/SHCA	POTR/ASMI
POTR/PTAQ	POTR-ABLA/AMAL	POTR/JUCO/ASMI
POTR/FETH	POTR-ABLA/SYOR/THFE	
POTR/STCO	POTR-ABLA/SYOR/BRCA	
POTR/RUPA	POTR-ABLA/JUCO	
POTR/SARA	POTR-ABLA/CAGE	
POTR/SYOR/FETH	POTR-PICO/THFE	
POTR/SYOR/CARO	POTR-PICO/SYOR	
POTR/SYOR/WYAM	POTR-PICO/CAGE	
POTR/JUCO/LUAR	POTR-PSME/AMAL	
POTR/SASC	POTR-PSME/SYOR	
POTR/AMAL/PTAQ	POTR-PSME/JUCO	
POTR/SHCA	POTR-PSME/CARU	
	POTR-ABCO/ARPA	
	POTR-ABCO/POPR	
	POTR-PIPU	
	POTR-PIFL	
	POTR-PIPO	

The key then proceeds to define community types on the basis of presence of critical amounts of key indicator species or guilds of species. Once a community type designation is identified, the description of the type in the text and the composition given in appendix F should be reviewed to validate the identification. Immediately following the type designation in the key, the abundance status of the type (whether major, minor, or incidental) and the page number where the type is described narratively are given in parentheses. Approximately 5 percent of the stands that would likely be encountered in the Intermountain Region cannot be classified by using this key. These should fall out in the key as "Unclassified types."

Type descriptions are arranged by abundance groups with the most common types described first and least common types last. Each description includes information on where the type was observed, environmental factors, community structure and species composition, estimated successional status, productivity, and miscellaneous. In the key and descriptions, the term "community type" is abbreviated to "c.t." and in the plural form to "c.t.'s".

A field form (appendix F) has been prepared to facilitate collection of the information needed for classifying aspen stands into their respective community types. This form includes a listing of only those plant species needed to define the type. The list consists of nine tree species, 14 shrubs, 12 graminoids, and 18 forbs. Data can be gathered and entered onto this form in the field and subsequently keyed to the appropriate type. Preferably, keying should take place while in the field to enable reevaluation of cover estimates if uncertainties are encountered in using the key.

Keys to Cover Types and Community Types

These keys cover vegetation in aspen community types (c.t.'s) in the Intermountain Region where *Populus tremuloides* constitutes at least 50 percent of the tree canopy. Note that the "tall forb group" referred to consists of the following species:

Agastache urticifolia
Aster engelmannii
Delphinium occidentale+
Hackelia floribunda
Heracleum lanatum
Mertensia arizonica+
Osmorhiza occidentalis
Senecio serra +
Valeriana occidentalis

The adjective descriptors are:

trace = less than 1 percent cover
scarce, present, readily apparent = 1 percent to 4 percent cover
conspicuous = 5 percent or greater cover
prominent = 10 percent or greater cover

The type abundance and page number of narrative description follow community type name. For example: (major, p. 68).

Key to Cover Types:

I.	*Abies lasiocarpa* or *Picea engelmannii* or both at least 10 percent canopy cover	*Populus tremuloides-Abies lasiocarpa* (Go to B in "Community Type" section)
I.	*A. lasiocarpa* and *P. engelmannii* less than 10 percent cover	II
II.	*Pinus contorta* at least 10 percent canopy cover	*Populus tremuloides-Pinus contorta* (Go to C)
II.	*P. contorta* less than 10 percent cover	III
III.	*Pseudotsuga menziesii* at least 10 percent canopy cover	*Populus tremuloides-Pseudotsuga menziesii* (Go to D)
III.	*P. menziesii* less than 10 percent cover	IV
IV.	*Abies concolor* at least 10 percent canopy cover	*Populus tremuloides-Abies concolor* (Go to E)
IV.	*A. concolor* less than 10 percent cover	V
V.	*Picea pungens* at least 10 percent canopy cover	*Populus tremuloides-Picea pungens* (inciden., p. 78)
V.	*P. pungens* less than 10 percent cover	VI
VI.	*Pinus flexilis* at least 10 percent canopy cover	*Populus tremuloides-Pinus flexilis* (inciden., p. 79)
VI.	*P. flexilis* less than 10 percent cover	VII
VII.	*Pinus ponderosa* at least 10 percent canopy cover	*Populus tremuloides-Pinus ponderosa* (inciden., p. 79)
VII.	*P. ponderosa* less than 10 percent cover	VIII
VIII.	Some other coniferous trees at least 10 percent canopy cover	Unclassified cover type
VIII.	Not as above	*Populus tremuloides* (Go to A)

Key to Community Types:

A. ***POPULUS TREMULOIDES* cover type**

1.	*Amelanchier alnifolia*, *Prunus virginiana*, *Acer grandidentatum* or *Salix scouleriana*, alone or in combination, prominent, generally exceeding 10 percent canopy cover	Tall Shrub Undergrowth Type (Go to AA)
1.	Above-named shrubs totaling less than 10 percent cover	2
2.	*Symphoricarpos oreophilus*, *Pachystima myrsinites*, and *Rosa* spp., alone or in combination, prominent with at least 10 percent canopy cover; or, *Juniperus communis*, *Artemisia tridentata*, *Shepherdia canadensis*, *Sambucus* spp., or *Rubus parviflorus* with at least 10 percent canopy cover	Low Shrub Undergrowth Type (Go to AB)
2.	Not as above	Herb Undergrowth Type (Go to AC)

AA. Tall Shrub Undergrowth Type

1.	*Salix scouleriana* prominent tall shrub with at least 10 percent canopy cover	*Populus tremuloides/Salix scouleriana* c.t. (inciden., p. 59)
1.	*S. scouleriana* absent, or may be present in lesser amounts than above	2
2.	*Pteridium aquilinum* conspicuous with at least 5 percent cover, and usually in excess of 20 percent cover	*Populus tremuloides/Amelanchier alnifolia/Pteridium aquilinum* (inciden., p. 60)
2.	*P. aquilinum* absent or scarce	3
3.	*Symphoricarpos oreophilus*, *Pachystima myrsinites*, *Rosa* spp., or *Spiraea betulifolia*, alone or in combination, prominent low shrubs, usually with combined canopy cover substantially exceeding 10 percent	4
3.	Not as above	8
4.	One or more members of the tall forb group (see key caption) prominent, alone or in combination, forming at least 10 percent cover; or tall forbs readily apparent in a sparse herbaceous layer	*Populus tremuloides/Amelanchier alnifolia-Symphoricarpos oreophilum*/Tall Forb c.t. (major, p. 25)

4. Tall forbs absent, or relatively inconspicuous 5

5. *Calamagrostis rubescens* or *Carex geyeri* or both prominent with at least 10 percent and frequently more than 20 percent canopy cover .... *Populus tremuloides/Amelanchier alnifolia-Symphoricarpos oreophilus/ Calamagrostis rubescens* c.t. (major, p. 31)

5. Not as above 6

6. *Thalictrum fendleri*, *Osmorhiza chilensis*, or *Geranium viscosissimum*, alone or in combination, prominent, generally exceeding 10 percent cover .... *Populus tremuloides/Amelanchier alnifolia-Symphoricarpos oreophilus/ Thalictrum fendleri* c.t. (major, p. 36)

6. Above-named species absent or scarce 7

7. *Bromus carinatus, Elymus glaucus,* and *Agropyron trachycaulum*, alone or in combination, conspicuous, generally exceeding 5 percent cover .... *Populus tremuloides/Amelanchier alnifolia-Symphoricarpos oreophilus/ Bromus carinatus* c.t. (minor, p. 51)

7. Not as above .... Unclassified type

8. One or more members of the tall forb group (see key caption), alone or in combination, prominent forming at least 10 percent cover, or tall forbs readily apparent in a sparse herbaceous layer .... *Populus tremuloides/Amelanchier alnifolia/* Tall Forb c.t. (minor, p. 50)

8. Tall forbs absent or inconspicuous 9

9. *Thalictrum fendleri*, *Osmorhiza chilensis*, or *Geranium viscosissimum*, alone or in combination, prominent with at least 10 percent total canopy cover .... *Populus tremuloides/Amelanchier alnifolia/ Thalictrum fendleri* c.t. (minor p. 50)

9. Not as above .... Unclassified type

AB. Low Shrub Undergrowth Type

1. *Rubus parviflorus* abundant with canopy cover exceeding 30 percent .... *Populus tremuloides/Rubus parviflorus* c.t. (inciden., p. 57)

1. *R. parviflorus* may be present, but not an undergrowth dominant 2

2. *Sambucus* spp. a prominent shrub with at least 10 percent canopy cover; members of the tall forb group frequently abundant .... *Populus tremuloides/Sambucus racemosa* c.t. (inciden., p. 57)

2. *Sambucus* spp. absent or scarce; if present, then less than 10 percent cover 3

3. *Shepherdia canadensis* prominent with at least 10 percent cover .... *Populus tremuloides/Shepherdia canadensis* c.t. (inciden., p. 68)

3. *S. canadensis* absent or scarce 4

4. *Artemisia tridentata* prominent with at least 10 percent canopy cover .... *Populus tremuloides/Artemisia tridentata* c.t. (minor, p. 44)

4. *A. tridentata* absent or scarce, less than 10 percent cover 5

5. *Juniperus communis* prominent with at least 10 percent cover 6

5. *J. communis* absent, or present with less than 10 percent cover 9

6. *Carex geyeri* or *Calamagrostis rubescens* prominent, at least 10 percent cover and usually more .... *Populus tremuloides/Juniperus communis/ Carex geyeri* c.t. (minor, p. 46)

6. *C. geyeri* and *C. rubescens* usually absent; if present, then not prominent 7

7. *Lupinus argenteus* prominent, or at least readily apparent if the herb layer is sparse .... *Populus tremuloides/Juniperus communis/ Lupinus argenteus* c.t. (inciden., p. 66)

7. Not as above 8

8. *Astragalus miser* prominent, or readily apparent if the herb layer is sparse .... *Populus tremuloides/Juniperus communis/ Astragalus miser* c.t. (inciden., p. 66)

8. Not as above .... Unclassified type

9. *Symphoricarpos oreophilus*, *Pachystima myrsinites*, or *Rosa* spp., alone or in combination, prominent with at least 10 percent cover 10

9. Not as above .... (Go to AC)

10. *Wyethia amplexicaulis* conspicuous, usually with cover exceeding 10 percent .... *Populus tremuloides/Symphoricarpos oreophilus/Wyethia amplexicaulis* c.t. (inciden., p. 64)

10. *W. amplexicaulis* absent or scarce 11

11. *Festuca thurberi* conspicuous, usually exceeding 10 percent cover .... *Populus tremuloides/Symphoricarpos oreophilus/Festuca thurberi* c.t. (inciden., p. 62)

11. *F. thurberi* absent or scarce 12

12.	One or more tall forbs (see key caption) prominent, alone or in combination forming at least 10 percent cover; or tall forbs readily apparent in a sparse herbaceous stratum	*Populus tremuloides/Symphoricarpos oreophilus/*Tall Forb c.t. (major, p. 23)
12.	Tall forbs absent or inconspicuous	13
13.	*Calamagrostis rubescens* or *Carex geyeri* prominent with at least 10 percent cover; or, forming a conspicuous part of a sparse herbaceous stratum	*Populus tremuloides/Symphoricarpos oreophilus/Calamagrostis rubescens* c.t. (major, p. 30)
13.	*C. rubescens* and *C. geyeri* absent or not readily apparent	14
14.	*Thalictrum fendleri*, *Osmorhiza chilensis*, or *Geranium viscosissimum*, alone or in combination, prominent, usually exceeding 10 percent cover; or a conspicuous element in a sparse herb stratum	*Populus tremuloides/Symphoricarpos oreophilus/Thalictrum fendleri* c.t. (major, p. 35)
14.	These low forbs absent or scarce, not comprising a conspicuous part of the undergrowth	15
15.	*Bromus carinatus, Elymus glaucus,* or *Agropyron trachycaulum*, alone or in combination, prominent, usually with more than 10 percent canopy cover; or a conspicuous element in a somewhat sparse herb stratum	*Populus tremuloides/Symphoricarpos oreophilus/Bromus carinatus* c.t. (major, p. 42)
15.	Not as above	16
16.	*Carex rossii* or *Bromus anomalus*, alone or combined, form a conspicuous part of a rather sparse herb stratum	*Populus tremuloides/Symphoricarpos oreophilus/Carex rossii* c.t. (inciden., p. 63)
16.	*C. rossii* and *B. anomalus* absent or inconspicuous	17
17.	*Poa pratensis* prominent and usually the dominant herbaceous plant	*Populus tremuloides/Symphoricarpos oreophilus/Poa pratensis* c.t. (minor, p. 49)
17.	Not as above	Unclassified type
AC.	**Herb Undergrowth Type**	
1.	*Veratrum californicum* prominent, generally exceeding 10 percent canopy cover	*Populus tremuloides/Veratrum californicum* c.t. (inciden., p. 56)
1.	*V. californicum* absent or scarce	2
2.	*Pteridium aquilinum* prominent with at least 10 percent canopy cover; usually exceeds 20 percent cover	*Populus tremuloides/Pteridium aquilinum* c.t. (inciden., p. 59)
2.	*P. aquilinum* either absent or scarce	3
3.	*Wyethia amplexicaulis* prominent with at least 10 percent cover; usually exceeds 20 percent cover	*Populus tremuloides/Wyethia amplexicaulis* c.t. (minor, p. 43)
3.	*W. amplexicaulis* absent or scarce	4
4.	*Festuca thurberi* a conspicuous member of the undergrowth with usually more than 5 percent cover	*Populus tremuloides/Festuca thurberi* c.t. (inciden., p. 61)
4.	*F. thurberi* absent or inconspicuous	5
5.	One or more members of the tall forb group (see key caption) prominent, alone or in combination at least 10 percent cover	*Populus tremuloides/*Tall Forb c.t. (major, p. 20)
5.	Tall forbs, if present, form less than 10 percent canopy cover	6
6.	*Calamagrostis rubescens* or *Carex geyeri* prominent with at least 10 percent cover, usually more	*Populus tremuloides/Calamagrostis rubescens* c.t. (major, p. 28)
6.	C. *rubescens* and *C. geyeri* absent or scarce	7
7.	*Thalictrum fendleri, Geranium viscosissimum,* or *Osmorhiza chilensis*, alone or in combination, prominent with at least 10 percent cover	*Populus tremuloides/Thalictrum fendleri* c.t. (major, p. 33)
7.	Not as above	8
8.	*Carex rossii* or *Bromus anomalus* or both usually prominent with at least 10 percent cover, or conspicuous in a sparse perennial undergrowth	*Populus tremuloides/Carex rossii* c.t. (major, p. 38)
8.	Above species absent or inconspicuous	9
9.	*Bromus carinatus, Elymus glaucus,* or *Agropyron trachycaulum*, alone or in combination, usually prominent with at least 10 percent cover	*Populus tremuloides/Bromus carinatus* c.t. (major, p. 40)
9.	Above grasses absent or not conspicuous	10

10. *Poa pratensis* dominates undergrowth ..... *Populus tremuloides/Poa pratensis* c.t. (minor, p. 47)

10. *P. pratensis* may be present, but does not dominate the undergrowth 11

11. *Stipa comata, Festuca idahoensis*, or *Sitanion hysterix*, alone or in combination, prominent ..... *Populus tremuloides/Stipa comata* c.t. (inciden., p. 67)

11. Above grasses absent or inconspicuous 12

12. *Astragalus miser* prominent, usually with more than 10 percent cover, or conspicuous in sparse undergrowth ..... *Populus tremuloides/Astragalus miser* c.t. (inciden., p. 64)

12. *A. miser* absent or inconspicuous 13

13. One or more members of the tall forb group form a conspicuous part of rather sparse perennial undergrowth ..... *Populus tremuloides*/Tall Forb c.t. (major, p. 20)

13. Tall forbs not conspicuous 14

14. *Thalictrum fendleri, Osmorhiza chilensis*, or *Geranium viscosissimum*, alone or in combination, readily apparent in rather sparse undergrowth ..... *Populus tremuloides/Thalictrum fendleri* c.t. (major, p. 33)

14. Above forbs inconspicuous 15

15. *Bromus carinatus, Elymus glaucus*, or *Agropyron trachycaulum*, alone or in combination, readily apparent in rather sparse perennial undergrowth ..... *Populus tremuloides/Bromus carinatus* c.t. (major, p. 40)

15. Not as above ..... Unclassified type

B. ***POPULUS TREMULOIDES—ABIES LASIOCARPA* cover type**

1. *Shepherdia canadensis* prominent, at least 10 percent cover ..... *Populus tremuloides-Abies lasiocarpa/Shepherdia canadensis* c.t. (inciden., p. 68)

1. *S. canadensis* absent or scarce 2

2. *Amelanchier alnifolia, Prunus virginiana*, or *Acer grandidentatum* prominent, alone or in combination, at least 10 percent canopy cover; *Symphoricarpos* spp. usually prominent ..... *Populus tremuloides-Abies lasiocarpa/Amelanchier alnifolia* c.t. (inciden., p. 69)

2. Not as above 3

3. *Juniperus communis* conspicuous and usually prominent; *Bromus anomalus* or *Carex rossii* often present ..... *Populus tremuloides-Abies lasiocarpa/Juniperus communis* c.t. (inciden., p. 71)

3. *J. communis* absent or scarce 4

4. *Symphoricarpos* spp., *Pachystima myrsinites*, or *Rosa* spp., alone or in combination, prominent with at least 10 percent canopy cover 5

4. Not as above 8

5. One or more members of the tall forb group (see key caption), alone or in combination, prominent, or at least forming a conspicuous part of the undergrowth ..... *Populus tremuloides-Abies lasiocarpa/Symphoricarpos oreophilus/*Tall Forb c.t. (minor, p. 52)

5. Tall forbs not a conspicuous part of the undergrowth 6

6. *Thalictrum fendleri, Osmorhiza chilensis*, or *Geranium viscosissimum*, alone or in combination, prominent, or at least forming a conspicuous part of the undergrowth ..... *Populus tremuloides-Abies lasiocarpa/Symphoricarpos oreophilus/ Thalictrum fendleri* c.t. (inciden., p. 70)

6. Not as above 7

7. *Bromus carinatus, Elymus glaucus*, or *Agropyron trachycaulum*, alone or in combination, prominent with at least 10 percent canopy cover ..... *Populus tremuloides-Abies lasiocarpa/Symphoricarpos oreophilus/Bromus carinatus* c.t. (inciden., p. 70)

7. Not as above ..... Unclassified *Populus-Abies* cover type

8. One or more members of the tall forb group (see key caption), alone or in combination, prominent, or at least forming a conspicuous part of the undergrowth ..... *Populus tremuloides-Abies lasiocarpa/*Tall Forb c.t. (major, p. 26)

8. Tall forbs not a conspicuous part of the undergrowth 9

9. *Carex geyeri* or *Calamagrostis rubescens* usually prominent, but may be only conspicuous if other undergrowth is sparse ..... *Populus tremuloides-Abies lasiocarpa/Carex geyeri* c.t. (inciden., p. 71)

9. Neither *C. geyeri* nor *C. rubescens* conspicuous 10

10. *Thalictrum fendleri*, *Osmorhiza chilensis*, or *Geranium viscosissimum*, alone or in combination, usually prominent, but at least conspicuous .... *Populus tremuloides-Abies lasiocarpa/Thalictrum fendleri* c.t. (minor, p. 53)

10. Not as above 11

11. *Carex rossii*, *Bromus anomalus*, or *Trifolium* spp. form a conspicuous part of a generally sparse undergrowth .... *Populus tremuloides-Abies lasiocarpa/Carex rossii* c.t. (major, p. 39)

11. Not as above .... Unclassified *Populus-Abies* cover type

C. *POPULUS TREMULOIDES —PINUS CONTORTA* cover type

1. *Symphoricarpos* spp., *Rosa* spp., or *Pachystima myrsinites*, alone or in combination, prominent with at least 10 percent canopy cover .... *Populus tremuloides-Pinus contorta/Symphoricarpos oreophilus* c.t. (inciden., p. 72)

1. Above species may be present, but not prominent 2

2. *Juniperus communis* conspicuous and usually prominent; *Carex geyeri* or *Astragalus miser* frequently present .... *Populus tremuloides-Pinus contorta/Juniperus communis* c.t. (minor, p. 54)

2. Not as above 3

3. *Carex geyeri* or *Calamagrostis rubescens* prominent, usually exceeding 10 percent canopy cover .... *Populus tremuloides-Pinus contorta/Carex geyeri* c.t. (inciden., p. 73)

3. Above graminoids may be present, but not a prominent part of the undergrowth 4

4. *Thalictrum fendleri*, *Osmorhiza chilensis*, or *Geranium viscosissimum*, alone or in combination, a conspicuous element of the undergrowth .... *Populus tremuloides-Pinus contorta/Thalictrum fendleri* c.t. (inciden., p. 73)

4. Not as above .... Unclassified *Populus-Pinus* cover type

D. *POPULUS TREMULOIDES—PSEUDOTSUGA MENZIESII* cover type

1. *Amelanchier alnifolia*, *Prunus virginiana*, or *Acer* spp., alone or in combination, prominent generally exceeding 10 percent canopy cover .... *Populus tremuloides-Pseudotsuga menziesii/Amelanchier alnifolia* c.t. (inciden., p. 74)

1. Above shrubs absent or scarce 2

2. *Juniperus communis* a prominent low shrub .... *Populus tremuloides-Pseudotsuga menziesii/Juniperus communis* c.t. (inciden., p. 76)

2. *J. communis* usually absent and never prominent 3

3. *Symphoricarpos* spp., *Pachystima myrsinites*, *Spiraea betulifolia*, or *Rosa* spp., alone or in combination, prominent low shrubs with at least 10 percent canopy cover .... *Populus tremuloides-Pseudotsuga menziesii/Symphoricarpos oreophilus* c.t. (inciden., p. 75)

3. Above shrubs may be present, but never prominent 4

4. *Calamagrostis rubescens* or *Carex geyeri* abundant with canopy cover generally exceeding 20 percent .... *Populus tremuloides-Pseudotsuga menziesii/Calamagrostis rubescens* c.t. (inciden., p. 76)

4. Not as above .... Unclassified *Populus-Pseudotsuga* cover type

E. *POPULUS TREMULOIDES—ABIES CONCOLOR* cover type

1. *Arctostaphylos patula* conspicuous and usually prominent .... *Populus tremuloides-Abies concolor/Arctostaphylos patula* c.t. (inciden., p. 77)

1. *A. patula* absent or only incidental 2

2. *Symphoricarpos oreophilus*, *Rosa woodsii*, or *Pachystima myrsinites*, alone or in combination, prominent with canopy cover usually exceeding 10 percent .... *Populus tremuloides-Abies concolor/Symphoricarpos oreophilus* c.t. (minor, p. 54)

2. Above low shrubs frequently present, but never prominent 3

3. *Poa pratensis* a conspicuous component of the undergrowth, usually comprising over 10 percent of the canopy cover .... *Populus tremuloides-Abies concolor/Poa pratensis* c.t. (inciden., p. 77)

3. Not as above .... Unclassified *Populus-Abies* cover type

MAJOR ASPEN COMMUNITY TYPES

Populus tremuloides/Tall Forb Community Type (POTR/TALL FORB c.t.)

Distribution—The POTR/TALL FORB c.t., the most commonly encountered aspen type in the Intermountain Region, accounted for over 11 percent of all stands classified. The type is most prevalent in northern Utah on the Wasatch-Cache and Uinta National Forests, particularly on the Bear River and Wasatch Mountain ranges and on the west end of the Uinta Mountains. Approximately a fifth of the stands sampled on the Uinta National Forest, 15 percent on the Bridger-Teton and Manti-LaSal National Forests, and 14 percent on the Wasatch-Cache National Forest occurred in this type (appendix C). It is also common on the Jarbidge and Independence mountain ranges in northern Nevada. Of the stands sampled on the Humboldt National Forest 18 percent were in this type. Elsewhere it is widely scattered. Although infrequent south of 39° latitude, it has been observed at mid- to high elevations in the Abajo Mountains in the southeast and on the Markagunt Plateau in southwestern Utah.

This is a mid- to upper elevation type. Three-fourths of the stands were between 7,000 and 9,000 ft (2,100 and 2,750 m) elevation. Although not restricted by exposure, it was most frequent on northerly slopes of gentle to moderate steepness. The type was primarily on landform configurations concave to undulating; few stands were on convex topography. Stands occurred on relatively deep soils derived from sandstone, limestone, quartzite, and granitic parent rock; few grew on volcanic soils.

Vegetation—The vegetation of this common type is structurally simple but compositionally complex and variable. The tree layer generally consists only of *Populus tremuloides*. Occasionally, however, small amounts of conifers may be present. *Abies lasiocarpa*, the most common conifer associate, occurred with an average cover of 2 percent in approximately a third of the 228 stands sampled. Although the type lacks a shrub stratum per se, various shrubs may be present in small quantities. In fact, *Symphoricarpos oreophilus* occurred as an incidental shrub in almost two-thirds of the stands, and *Sambucus racemosa* was observed in almost a third of the stands. Consequently, the undergrowth consists almost exclusively of a highly variable and usually lush mixture of a broad range of forbs and graminoids.

The unifying characteristic of the type is the presence and usual prominence of one or more members of the tall forb group of species, the absence of a distinct layer of shrubs, and lack of substantial amounts of conifers in the tree layer (fig. 5). Members of this tall forb guild (and their constancy) are *Valeriana occidentalis* (59), *Osmorhiza occidentalis* (53), *Hackelia floribunda* (51), *Senecio serra* (49), *Agastache urticifolia* (47), *Mertensia arizonica* (33), *Delphinium occidentale* (32), *Aster engelmannii* (21), and *Heracleum lanatum* (12). No one member of this group is consistently prominent or even present, but as a group they usually make up at least 10 percent canopy cover. Occasionally, one tall forb species will overwhelmingly dominate the undergrowth. This is the case in some stands where *M. arizonica* or *H. lanatum* form the bulk of the undergrowth (fig. 6). If a stand has been subjected to extremely abusive grazing, a few members of the tall forb guild will often still be conspicuous in either a

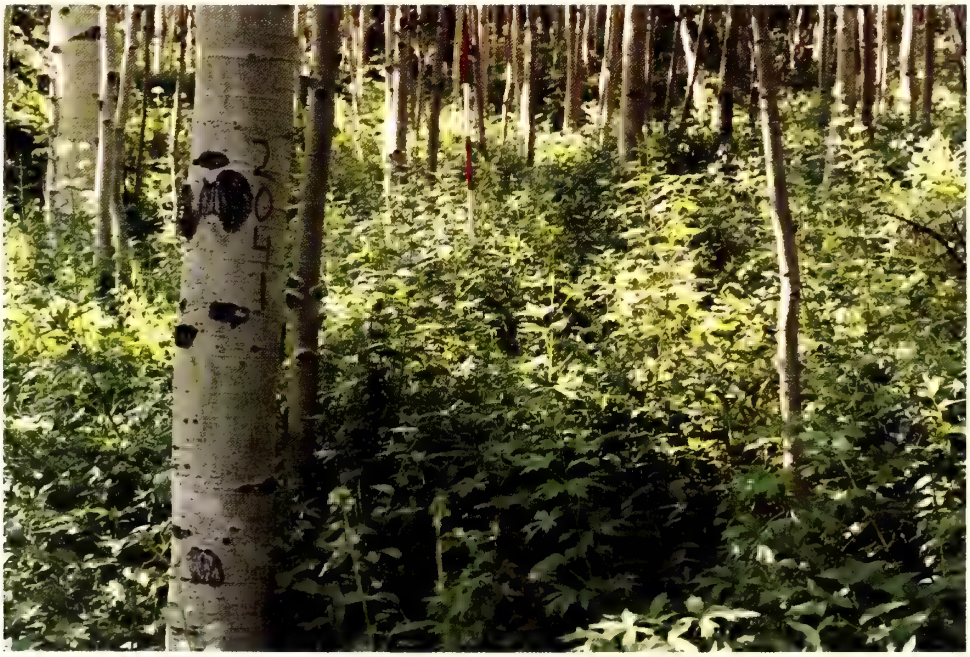

Figure 5—The *Populus tremuloides*/Tall Forb c.t., especially prevalent in northern Utah, is the most common community type in the Intermountain Region. The undergrowth typically consists of a diverse mixture of both tall and low forbs, and robust graminoids.

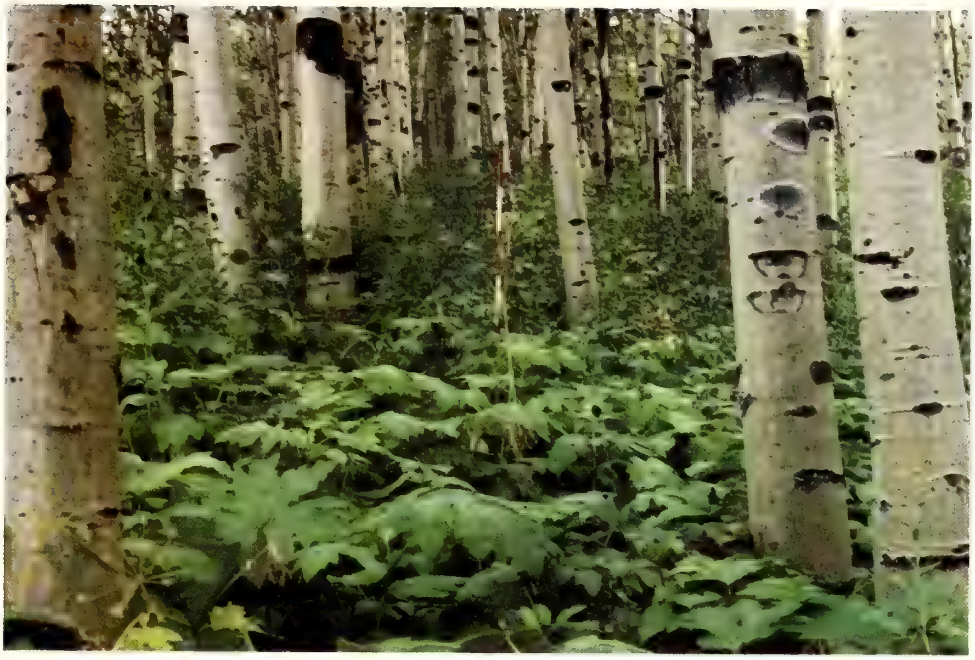

Figure 6—In contrast to the broad mixture of species in the undergrowth of most stands within the *Populus tremuloides*/Tall Forb c.t., a single tall forb species such as *Heracleum lanatum* will occasionally appear to dominate the undergrowth.

rather sparse undergrowth or intermixed with a dominant low-palatability species such as *Rudbeckia occidentalis*. The tall forb species are usually accompanied by a mixture of low forbs and graminoids. Most common low forbs are *Thalictrum fendleri, Osmorhiza chilensis, Geranium viscosissimum, Stellaria jamesiana,* and *Achillea millefolium*. The most common graminoids in this type are *Bromus carinatus, Elymus glaucus*, and *Agropyron trachycaulum*; at times these tall-growing grasses can be very abundant. Pocket gophers frequently churn the relatively deep, loose soil of this type, providing conditions amply suited for the growth of such annuals as *Nemophila breviflora, Galium bifolium, Collomia linearis, Descurainia richardsonii*, and *Polygonum douglasii*.

Succession—The majority of communities within the POTR/TALL FORB c.t. are believed to be near-climax aspen communities (that is, they represent a POTR/TALL FORB habitat type) or at least grazing-altered communities of an essentially climax type. Prolonged heavy grazing will probably cause a substantial reduction in species diversity. If abusively grazed by cattle for many years, a reduction in the amount of relatively palatable grasses and forbs can be expected with a shift in species composition to dominance by such relatively unpalatable forbs as *Rudbeckia occidentalis* (fig. 7) and possibly *Lathyrus* spp. Indeed, a *Populus tremuloides / R. occidentalis* c.t. may be in order to describe those conditions where *R. occidentalis* is very abundant and remnant members of the tall forb guild are no longer present. In some cases, *S. serra* may also increase substantially under heavy cattle use. Such use by sheep will tend to reduce the amount of palatable forbs and shift species composition toward dominance by such grasses as *E. glaucus* and *B. carinatus*. Prolonged abusive grazing by either class of livestock could eliminate most of the palatable perennials and favor an increase in annuals. Extreme cases of abusive grazing in this type may result in conversion of what was once a lush mixture of perennial grasses and forbs into an impoverished undergrowth consisting primarily of annuals (fig. 8). Some stands now classified as POTR/TALL FORB c.t. may actually represent a grazing-altered condition of a *Populus tremuloides / Symphoricarpos oreophilus*/Tall Forb, or a *P. tremuloides / Amelanchier alnifolia-Symphoricarpos oreophilus*/Tall Forb type. This change in classification status would be caused by the reduction of shrubs by browsing pressures.

At least a third of the stands within this type contained minor amounts of conifers, either as reproduction in the undergrowth or as an occasional tree in the overstory. In most cases, the conifer was *A. lasiocarpa*. In such cases, given the course of natural succession, these particular stands might be seral communities within an *A. lasiocarpa* forest climax series. An increase of *A. lasiocarpa* can be expected with time as additional reproduction becomes established. As conifers gradually begin to dominate the overstory, composition of the undergrowth vegetation gradually changes and becomes less productive as less light is able to penetrate to the forest floor and as duff accumulates with resulting changes in soil chemistry.

Production—The overall potential of this type for the production of wood appears to be slightly better than average, although this varies greatly between individual stands. A total of 64 stands were sampled for production. Tree basal area averaged 155 ft^2/acre (35.6 m^2/ha). An average 98 percent of this was aspen. Two-thirds of the stands can be expected to have basal areas between 107 and 209 ft^2/acre (24.6 and 48.0 m^2/ha). Site index at 80 years for aspen averaged 52 ft (15.7 m). Two-thirds of the

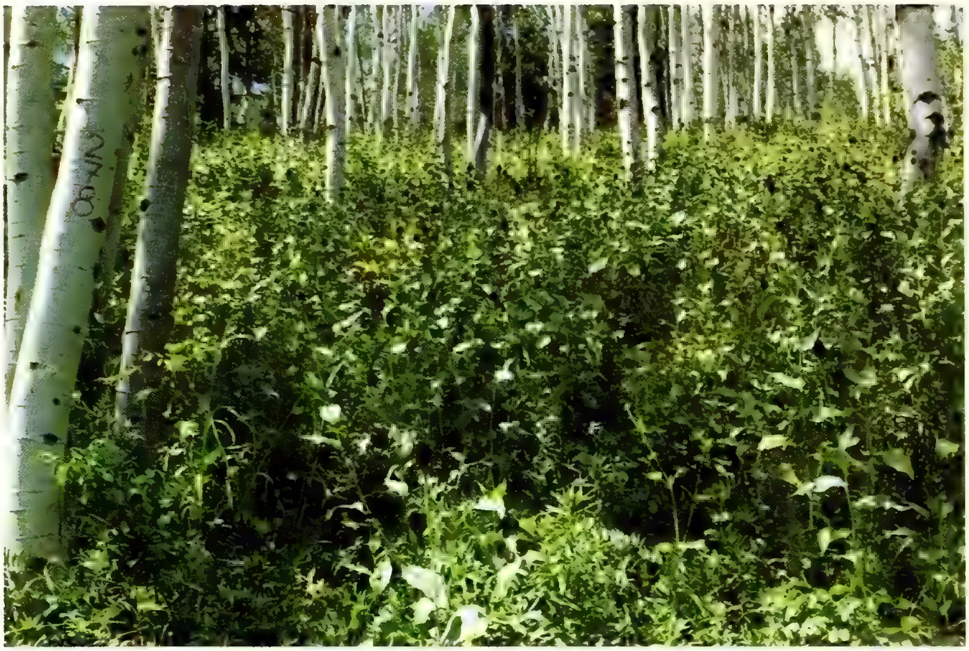

Figure 7—Undergrowth dominated by such relatively unpalatable forbs as *Rudbeckia occidentalis* frequently results from many years of excessive cattle grazing in the *Populus tremuloides*/Tall Forb c.t..

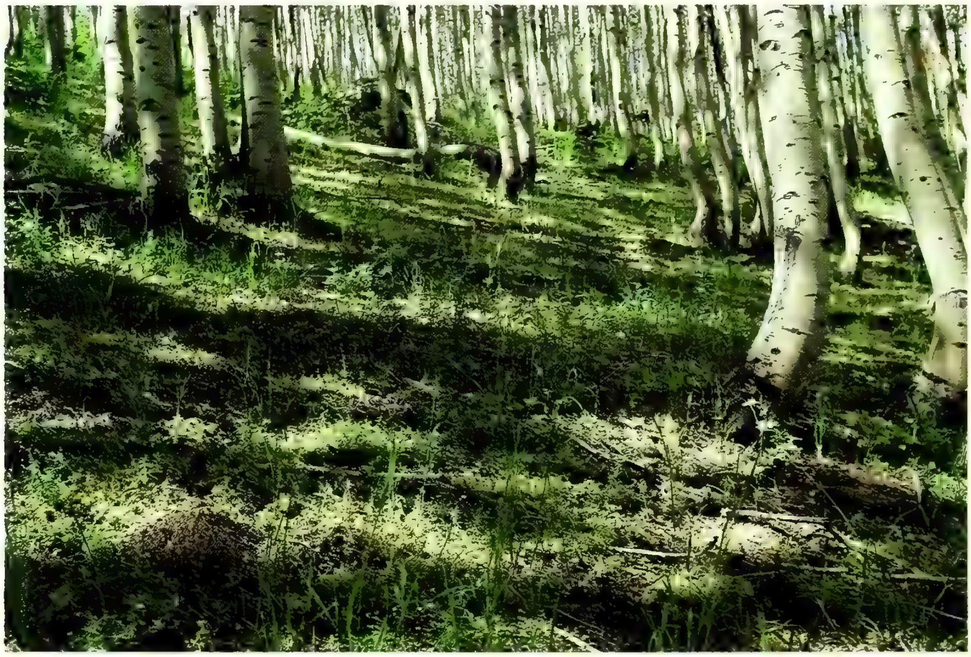

Figure 8—Prolonged, abusive livestock grazing can reduce the luxuriant, productive undergrowth of the *Populus tremuloides*/Tall Forb c.t. (fig. 5) to an impoverished condition dominated by such annuals as *Nemophila breviflora, Collomia linearis, Polygonum douglasii,* and *Galium biflorum,* with only trace amounts of the former perennial cover.

stands can be expected to have site indices between 42 and 62 ft (12.8 and 18.9 m). Volume growth of aspen averaged 41 ft^3/acre/year (2.9 m^3/ha/year), with two-thirds of the stands ranging between 28 and 54 ft^3/acre/year (1.96 and 3.78 m^3/ha/year). Aspen reproduction was highly variable but averaged in the upper quarter of the stands, or 2,653 suckers/acre (6,555/ha). Over half of these suckers were in the 1- to 4.6-ft (0.3- to 1.4-m) height class. Tree density averaged 972 stems/acre (2,401/ha), which was in the upper third of the stands.

Production of undergrowth is fairly high, ranking in the upper third of all aspen stands sampled. Average production of air-dry material was 1,107 lb/acre (1,240 kg/ha); two-thirds of the stands can be expected to produce between 570 and 1,644 lb/acre (638 and 1,841 kg/ha). The majority of this production consisted of forbs, an average 78 percent, with most of the rest graminoids, an average 17 percent. Only 5 percent of the growth was shrubs. Forage suitability for over two-thirds of this undergrowth was classified as desirable, 53 percent, or intermediate, 26 percent.

Thus, the POTR/TALL FORB c.t. appears in general to be slightly better than average for the production of wood fiber and much better than average for the production of forage. The abundance of forbs in relation to graminoids indicates that the type is better suited as summer range for sheep than for cattle. The value as wildlife habitat is moderately good for foraging but marginal as cover because of the low structural diversity of the vegetation, and especially because of the absence of an effective shrub component in the undergrowth.

Other—Communities belonging to the POTR/TALL FORB c.t. were recognized in earlier aspen classifications for the Region, but different epithets were used to name it. Communities within the *Populus tremuloides / Rudbeckia occidentalis, P. tremuloides / Heracleum lanatum*, and *P. tremuloides / Ligusticum filicinum* c.t.'s of classification for the Bridger-Teton National Forest (Youngblood and Mueggler 1981) are now lumped into the POTR/TALL FORB c.t. Communities within the *P. tremuloides / Rudbeckia occidentalis* c.t. in the Caribou and Targhee National Forest classification (Mueggler and Campbell 1982) are now placed in this type. And communities identified as within the *P. tremuloides / Senecio serra* and *P. tremuloides / Heracleum lanatum* c.t.'s in the Utah classification (Mueggler and Campbell 1986) are now combined in this type. The POTR/TALL FORB c.t. supersedes all of the above types described in these earlier classifications.

Not only is the POTR/TALL FORB c.t. common in the Intermountain Region, aspen communities with similar vegetation structure and characterizing species appear to be fairly common in the central Rocky Mountains. About two-thirds of the stands Hoffman and Alexander (1980, 1983) used to characterize the *P. tremuloides / Thalictrum fendleri* habitat type on the Routt and White River National Forests in western Colorado, and about one-third of the stands in this type in the Medicine Bow National Forest in southeastern Wyoming (Alexander and others 1986), contain the tall forb and grass components similar to our POTR/TALL FORB c.t. Their *P. tremuloides / T. fendleri* type appears to be primarily a generalized combination of our POTR/TALL FORB and POTR/CARU types.

Populus tremuloides/Symphoricarpos oreophilus/Tall Forb Community Type (POTR/SYOR/TALL FORB c.t.)

Distribution—The POTR/SYOR/TALL FORB c.t. is the second most common type in the Region and accounts for over 10 percent of all stands sampled. As with the POTR/TALL FORB c.t., it is primarily confined to the northern half of the Region and seldom occurs south of 39° latitude. It is the most frequently encountered type on the Uinta National Forest where it accounts for 27 percent of the stands. Over 10 percent of the stands on the Caribou, Wasatch-Cache, Manti-LaSal, and Humboldt National Forests were of this type. It is common on the Bear River, Wasatch, and west end of the Uinta Mountains in northern Utah, and on the Jarbidge and Santa Rosa Mountains of northern Nevada. Although it was found on the Bridger-Teton National Forest in western Wyoming, it was not nearly as abundant there as was the closely related POTR/TALL FORB c.t.

This is typically an intermediate elevation type. Over two-thirds of the stands within the Region were at less than 8,000 ft (2,400 m) elevation. The type clearly demonstrates the effect of latitude upon the elevational distribution of a plant community. In northern Utah on the Wasatch-Cache National Forest, stands occurred at elevations between 6,200 and 8,800 ft (1,890 and 2,680 m). In central Utah on the Manti-LaSal National Forest, an average 2° latitude farther south, the type occurred at elevations generally about 1,000 ft (300 m) higher, between 7,700 and 9,700 ft (2,350 and 2,960 m) elevation. The type was usually on fairly gentle slopes of less than 25 percent steepness, irrespective of aspect. Although it occurred on a wide variety of soils, almost half of the stands were on sandstone parent material.

Vegetation—Species composition in this common type is similar to that of the POTR/TALL FORB c.t., except for the presence of a stratum of low shrubs composed primarily of *Symphoricarpos oreophilus*, or in some cases *Pachystima myrsinites, Rosa* spp., or possibly *Symphoricarpos albus*. Species diversity is usually great, with a wide variety of tall forbs, low forbs, graminoids, low shrubs, and annuals (fig. 9). An occasional tall shrub species such as *Amelanchier alnifolia* or *Prunus virginiana* may be present, but not to the extent of forming a separate stratum. The herbaceous stratum generally consists of a luxuriant mixture of forbs and graminoids. The most common tall forb species that characterize the type are *Agastache urticifolia, Senecio serra, Hackelia floribunda*, and *Valeriana occidentalis*. Other tall forbs that may be prominent include *Aster engelmannii, Mertensia arizonica*, and *Osmorhiza occidentalis*. In some cases, *Rudbeckia occidentalis* is common. Common low forbs include *Thalictrum fendleri, Geranium viscosissimum, Osmorhiza chilensis*, and *Stellaria jamesiana*. Occasionally, *Lathyrus* spp. will tend to form a mat covering much of the other undergrowth. The most common grasses in this type are the tall-growing *Bromus carinatus, Agropyron trachycaulum*, and *Elymus glaucus*. The type usually has an abundance of annuals growing on the rather loose, friable soil. The most common of these are *Nemophila breviflora, Descurainia richardsonii, Galium bifolium, Collomia linearis*, and *Polygonum douglasii.*

Succession—*Abies lasiocarpa* was present in small amounts in about a fourth of the 205 stands sampled. Given time, these stands might eventually succeed to dominance by this conifer, so they should be considered as

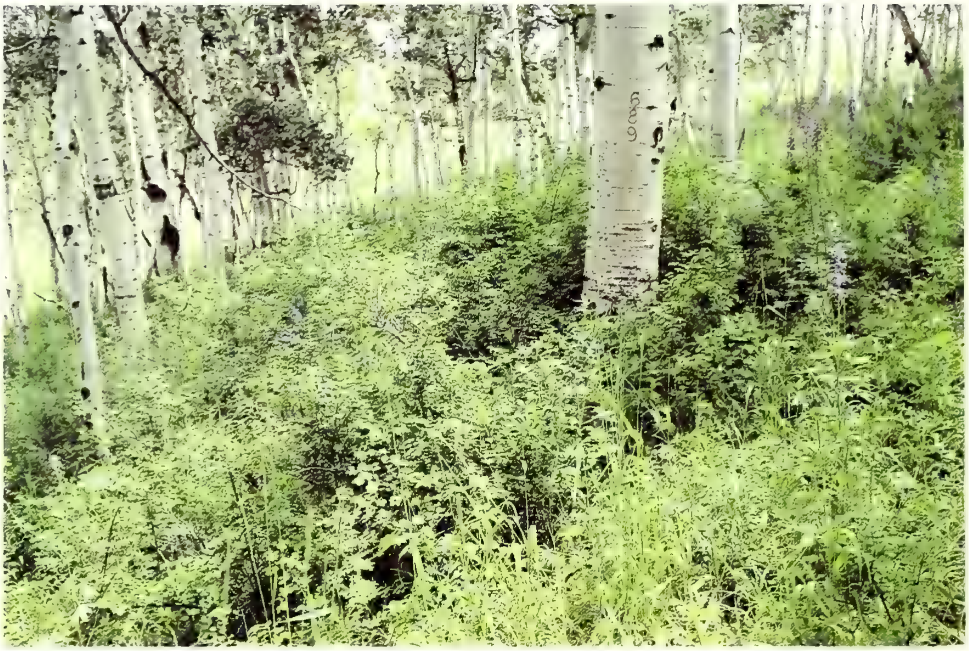

Figure 9—The *Populus tremuloides*/*Symphoricarpos oreophilus*/Tall Forb c.t., the second most common type in the Intermountain Region, is primarily found in the northern half. This stable aspen type typically consists of a rich mixture of tall and low forbs, graminoids, and low shrubs dominated by *S. oreophilus*.

occupying part of the *A. lasiocarpa* series of habitat types. Other stands had a few other conifers in minor amounts, principally *A. concolor* and *Pseudotsuga menziesii*. However, the majority of stands within the POTR/SYOR/TALL FORB type appeared to represent a condition where aspen is a stable or climax overstory species.

The undergrowth is essentially a shrub and forb complex that has undergone various degrees of alteration because of past grazing by sheep or cattle or both. Abusive livestock grazing usually reduces diversity of the undergrowth appreciably. Extended heavy use by sheep will likely shift species composition from the more palatable tall forbs and *S. oreophilus* to an undergrowth dominated by *E. glaucus, B. carinatus,* and possibly *Poa pratensis*. Excessive cattle grazing may shift composition to dominance by *R. occidentalis, Lathyrus* spp., *Vicia americana,* and possibly *M. arizonica* or *S. serra*. The dense blanket of *V. americana* and *Lathyrus* spp. sometimes found in these stands is probably an artifact of livestock use. Prolonged abusive grazing by livestock can eventually change the undergrowth to a depauperate condition where only unpalatable perennials and annuals remain.

Production—The wood-producing capacity of this type appears to be about average for aspen communities within the Region. Total tree basal area for the 41 stands sampled for production in the type averaged 130 ft^2/acre (29.8 m^2/ha). Two-thirds of the stands can be expected to have basal areas ranging between 79 and 181 ft^2/acre (18.1 and 41.6 m^2/ha). Site index for aspen at 80 years averaged 47 ft (14.3 m), with two-thirds of the stands expected to be between 35 and 59 ft (10.7 and 18.0 m). Wood volume production at maturity averaged 35 ft^3/acre/year (2.4 m^3/ha/year). Two-thirds of the stands should produce somewhere between 19 and 51 ft^3/acre/year (1.3 and 3.6 m^3/ha/year). Sucker regeneration appeared to be more favorable than in most of the types, with an average of 1,224 suckers/acre (3,024/ha). This was about evenly divided between small and large suckers but was highly variable between stands. For example, the production of suckers less than 1 ft (0.3 m) high ranged from none to over 24,000/acre (59,000/ha). Aspen trees averaged 855 stems/acre (2,112/ha), which was in the upper third of the stands. Two-thirds of the stands can be expected to have between 360 and 1,350 stems/acre (400 and 1,510 stems/ha).

Although the quantity of undergrowth varies from stand to stand, the overall average for the type ranks in the upper fourth of all aspen stands sampled. This productive mixture of vegetation classes averaged 1,224 lb/acre (1,372 kg/ha) of air-dry material. Two-thirds of the stands in this type will produce between 694 and 1,754 lb/acre (777 and 1,964 kg/ha). The majority of this herbage (63 percent) consisted of a diverse mixture of forbs, and the remainder was almost evenly divided between shrubs and graminoids. Overall suitability of this vegetation as forage for livestock ranked as 53 percent desirable, which is a little better than and median for all aspen communities. The least desirable forage category averaged a relatively high 15 percent.

In general then, the POTR/SYOR/TALL FORB c.t. appears to rank in the upper third of all stands in its potential to produce wood fiber. It is also regarded as productive livestock range, particularly for sheep. It produces ample amounts of palatable forbs as well as palatable browse species. Wildlife habitat values are better than in the POTR/TALL FORB c.t. because of the presence of a low-shrub stratum that enhances structural diversity, but the values are less than optimum because of the lack of a tall shrub layer and mixed conifers in the tree stratum.

Other—In earlier aspen classifications, communities within this type were recognized as separate entities but were given different names. In the Utah classification (Mueggler and Campbell 1986), these communities were identified as the *Populus tremuloides / Symphoricarpos oereophilus / Senecio serra* c.t. In the Caribou and Targhee National Forests classification (Mueggler and Campbell 1982), they were identified as the *P. tremuloides / S. oreophilus— Rudbeckia occidentalis* c.t. Part of the communities within the less specific *P. tremuloides / S. oreophilus* c.t. of the Bridger-Teton National Forest aspen classification (Youngblood and Mueggler 1981) are included in the new POTR/SYOR/TALL FORB c.t.

Populus tremuloides/Amelanchier alnifolia—Symphoricarpos oreophilus/ Tall Forb Community Type (POTR/AMAL-SYOR/TALL FORB c.t.)

Distribution—This major community type is most prevalent in the northern half of the Region and is particularly abundant on the Wasatch-Cache National Forest where it accounted for 10 percent of the aspen communities. It is also fairly abundant on the Caribou, Uinta, and Humboldt National Forests. Greatest concentrations appear to be along the Bear River and Wasatch Mountain ranges. A single stand was observed as far south as the Abajo Mountains in southeastern Utah.

The POTR/AMAL-SYOR/TALL FORB c.t. occurs at fairly low to moderate elevations. Elevational extremes ranged from a low of 5,500 ft (1,680 m) on the Wasatch-Cache National Forest to a high of 8,800 ft (2,690 m) on the Uinta. Over 80 percent of the stands sampled were encountered at elevations between 6,000 and 8,000 ft (1,800 and 2,440 m) and on slopes between 10 and 40 percent steepness. They occurred on all exposures and slope configurations. Although the type can be found on soils derived from a wide variety of parent materials, almost half occupied soils derived from sandstone.

Vegetation—Although the tree overstory consists almost exclusively of a single species, *Populus tremuloides*, the undergrowth is among the most complex of any of the aspen types. Structurally, the undergrowth consists of three layers: tall shrubs, low shrubs, and a complex mixture of herbs (fig. 10). The presence of a tall shrub layer is what distinguishes this type from the POTR/SYOR/TALL FORB c.t. This tall shrub stratum, consisting primarily of *Amelanchier alnifolia* and *Prunus virginiana*, is sometimes well defined and at other times scattered and open. In either event, combined canopy cover of the tall shrub species exceeds 10 percent. The low shrub stratum is generally well defined and consists primarily of *Symphoricarpos oreophilus*. *Rosa woodsii* is frequently present, and at times *Pachystima myrsinites* is abundant. The herbaceous undergrowth is a complex mixture of tall-growing forbs and grasses with a substantial component of low-growing herbs. The tall forb guild is represented by the prominence of one or more of the following characterizing species: *Agastache urticifolia, Aster engelmannii, Delphinium occidentale, Hackelia floribunda, Mertensia*

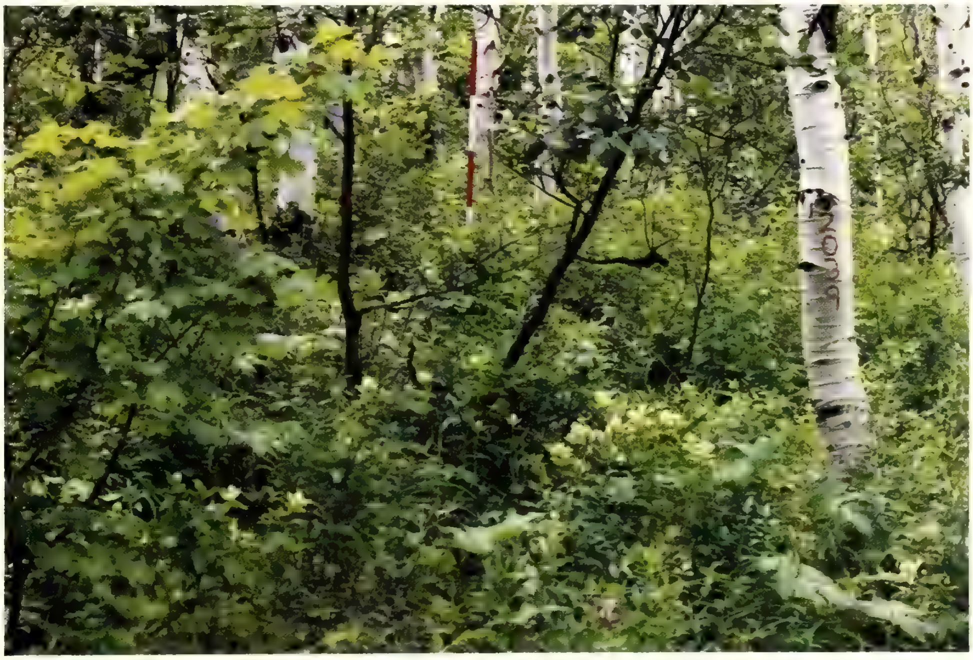

Figure 10—The structurally diverse *Populus tremuloides/Amelanchier alnifolia—Symphoricarpos oreophilus/*Tall Forb c.t. is common in the northern half of the Intermountain Region. The undergrowth consists of three principal strata: tall shrubs (usually *A. alnifolia* or *Prunus virginiana*), low shrubs (principally *S. oreophilus, Rosa woodsii,* or *Pachystima myrsinites*), and an herb layer dominated by tall forbs.

arizonica, Osmorhiza occidentalis, Senecio serra, Valeriana occidentalis, and *Heracleum lanatum.* Usually, no single species of this group dominates the undergrowth. Instead, the undergrowth contains a melange of several members of this group whose combined cover exceeds 10 percent. Exceptions exist where the herbaceous cover is dominated by only one member of the tall forb guild. Tall grasses are common, particularly *Elymus glaucus* and *Bromus carinatus*; frequently, *Agropyron trachycaulum, Poa pratensis,* and *Carex hoodii* are also conspicuous. Low-growing forbs generally are an important part of the herb stratum; the most commonly encountered and abundant of these are *Thalictrum fendleri, Osmorhiza chilensis,* and *Geranium viscosissimum*. Various species of *Lathyrus* and *Vicia americana* occasionally tend to blanket the low shrubs and herbs. Annual plants, particularly *Nemophila breviflora, Descurainia richardsonii, Galium bifolium,* and *Polygonum douglasii,* are common and sometimes abundant.

Succession—The POTR/AMAL-SYOR/TALL FORB c.t. is believed to be primarily a climax community type. Conifers are infrequent and present in only minuscule amounts. Stands within this type will likely remain dominated by a *Populus tremuloides* tree layer. Abusive grazing tends to appreciably decrease the amount of palatable forbs and shrubs. If grazed by sheep, grasses such as *E. glaucus, B. carinatus,* and *P. pratensis* tend to gain dominance. If grazed by cattle, *Rudbeckia occidentalis, Lathyrus* spp., and in some cases *S. serra* tend to increase substantially. Both the tall and low shrub species are likely to decrease under prolonged abusive grazing, particularly by sheep. Under these conditions, tall remnants of *A. alnifolia* and *P. virginiana* may exist over an herbaceous undergrowth dominated by annuals.

Production—The potential for wood production in this type appears to be somewhat below the average. Total tree basal area of the 28 stands sampled for production averaged 116 ft^2/acre (26.5 m^2/ha), aspen site index averaged 46 ft (14.1 m) at 80 years, and volume growth at stand maturity 34 ft^3/acre/year (2.4 m^3/ha/year). All of these averages were in the lower third of the values for all aspen stands. Two-thirds of the stands can be expected to have total tree basal areas between 88 and 144 ft^2/acre (20.2 and 33.1 m^2/ha), site indices for aspen between 37 and 55 ft (11.3 and 16.8 m), and volume growth of aspen between 22 and 46 ft^3/acre/year (1.5 and 3.2 m^3/ha/year). Aspen reproduction, however, was considerably better than in most aspen stands. The average of 2,540 suckers/acre (6,257/ha) was in the upper third of all stands; a third of these were taller than 1 ft (0.3 m). As is usually the case, sucker numbers were highly variable between stands. Tree numbers were about average at 782 stems/acre (1,932/ha). Two-thirds of the stands within this type can be expected to have between 361 and 1,203 stems/acre (892 and 2,973/ha).

The undergrowth in this type is not only highly diverse but also fairly productive. Annual air-dry production averaged 1,180 lb/acre (1,322 kg/ha), which is in the upper third of the stands. Two-thirds of the stands within the type can be expected to produce between 833 and 1,527 lb/acre (933 and 1,702 kg/ha). About half of this production consisted of forbs, an average 48 percent, and the remainder was about equally divided between shrubs (27 percent) and graminoids (25 percent). The undergrowth was in the mid range of forage suitability, with 54 percent desirable and 40 percent of intermediate suitability.

Overall multiple-use values, therefore, appear to be fairly high for the POTR/AMAL-SYOR/TALL FORB c.t. Although the potential for wood fiber production is slightly below average for aspen stands within the Region, both the values related to livestock forage and wildlife habitat are well above average. The relative abundance of forbs and shrubs in the undergrowth suggests that the type is better suited as summer range for sheep than for cattle. The great amount of structural diversity in the undergrowth enhances the general value of this type as wildlife habitat considerably beyond that of either the POTR/TALL FORB or POTR/SYOR/TALL FORB types.

Other—Most of the aspen communities formerly classified under the name of the *Populus tremuloides / Prunus virginiana / Senecio serra* c.t. in the Utah aspen classification (Mueggler and Campbell 1986) are now included in the POTR/AMAL-SYOR/TALL FORB c.t. A few of those communities identified in the Caribou and Targhee National Forests classification (Mueggler and Campbell 1982) as belonging to the *P. tremuloides / Amelanchier alnifolia—Symphoricarpos oreophilus* c.t. are now in the POTR/AMAL-SYOR/TALL FORB c.t. The new type name is considered a refinement over the more generalized earlier treatments by breaking out differences in vegetation structure and herbaceous components.

Although this particular type has not been reported elsewhere, similar communities likely occur at least in western Colorado. Aspen communities with both a tall shrub component of either *Amelanchier alnifolia* or *Prunus virginiana* and a low shrub component of *Symphoricarpos oreophilus* are included in reports by Hoffman and Alexander (1980, 1983) and by Johnston and Hendzel (1985).

Populus tremuloides—Abies lasiocarpa/Tall Forb Community Type (POTR-ABLA/TALL FORB c.t.)

Distribution—This major seral community type is most abundant in western Wyoming where it accounts for 8 percent of the aspen communities on the Bridger-Teton National Forest. It is widely scattered across most of the other Forests within the Region but is relatively infrequent in southern Utah and Nevada.

It is a moderate- to high-elevation type with three-fourths of the sampled stands at elevations above 8,000 ft (2,440 m). Elevational extremes ranged from a low of 6,600 ft (2,000 m) on the Caribou National Forest to a maximum elevation of 10,200 ft (3,100 m) on the Fishlake National Forest. Two-thirds of the 51 stands sampled were on northerly or easterly exposures of moderately steep slopes. Although apparently not restricted by soil parent materials, over half were on soils derived from either sandstones or limestones.

Vegetation—The structural diversity of this major type is enhanced by the presence of significant amounts of conifers, primarily *Abies lasiocarpa,* in the tree stratum. Frequently this is in the form of conifer reproduction that is slowly replacing the temporarily dominant *Populus tremuloides* (fig. 11). The type is characterized by at least 10 percent cover of *A. lasiocarpa* or *Picea engelmannii* or a combination, the absence of a well-defined layer of shrubs, and the prominence of one or more members of the tall forb group in the herb stratum. Thus, the structure of the undergrowth is fairly simple. The herb layer, however, is frequently a rather complex mixture of tall and low forbs and graminoids. The most commonly encountered tall forbs in this type are *Rudbeckia occidentalis, Aster engelmannii, Valeriana occidentalis, Delphinium occidentalis,* and *Osmorhiza occidentalis.* Grasses and low forbs also form an important part of the herb layer. The most common grasses are *Bromus carinatus, Elymus glaucus, Agropyron trachycaulum,* and *Poa nervosa.* The most common low herbs are *Osmorhiza chilensis, Thalictrum fendleri, Geranium viscosissimum, Taraxacum officinale,* and *Stellaria jamesiana.* Annuals are fairly common in the type, especially *Nemophila breviflora, Collomia linearis,* and *Descurainia richardsonii.* Shrubs such as *Symphoricarpos oreophilus, Ribes montigenum,* and *Sambucus racemosa* may be present but are never prominent enough to form a distinct stratum.

Succession—The POTR-ABLA/TALL FORB c.t. is a seral type in which the *P. tremuloides* overstory will eventually be replaced by *A. lasiocarpa* during succession. Comparisons with habitat types identified for Idaho (Steele and others 1983) and northern Utah (Mauk and Henderson 1984), based on commonality of species with high constancy, suggest that this seral type is most likely a succesional stage within the *A. lasiocarpa / Osmorhiza chilensis* habitat type (appendix E). As conifers increase in the overstory, reduced light on the forest floor, as well as possible changes created by duff buildup, appreciably alters undergrowth production and composition. The decrease in undergrowth production becomes pronounced with as little as 15 percent conifer cover in the overstory (Mueggler 1985b). Tall forbs and grasses tend to decline while such low forbs as *T. fendleri* and *O. chilensis* gain relative prominence. An aspen-dominated community can be maintained on these sites only if the conifers are removed, usually by burning or clearcutting (Schier and others 1985). When this occurs, *P. tremuloides* usually suckers rapidly and profusely from the remnant root system of this clonal species. The conifers, however, must reestablish from seed. The rapidity of aspen replacement by conifers depends to a great extent on the availability of a conifer seed source. Replacement might take place in less than 100 years if abundant conifer seedlings become established from residual seed immediately following the disturbance. In other cases, if conifer establishment depends upon gradual invasion from outside the stand, replacement of aspen may not occur for several hundred years.

Heavy sheep grazing in this type usually leads to replacement of many of the palatable tall forbs with an increased abundance of such tall grasses as *B. carinatus, E. glaucus,* and *A. trachycaulum.* Under heavy cattle use, these grasses and the palatable forbs tend to decrease and species such as *R. occidentalis, T. fendleri, O. chilensis,* and *Lathyrus* spp. become more prominent. If consistently grazed during the latter part of the growing season, *S. serra* and *M. arizonica* may increase substantially. Prolonged abusive grazing could lead to undergrowth

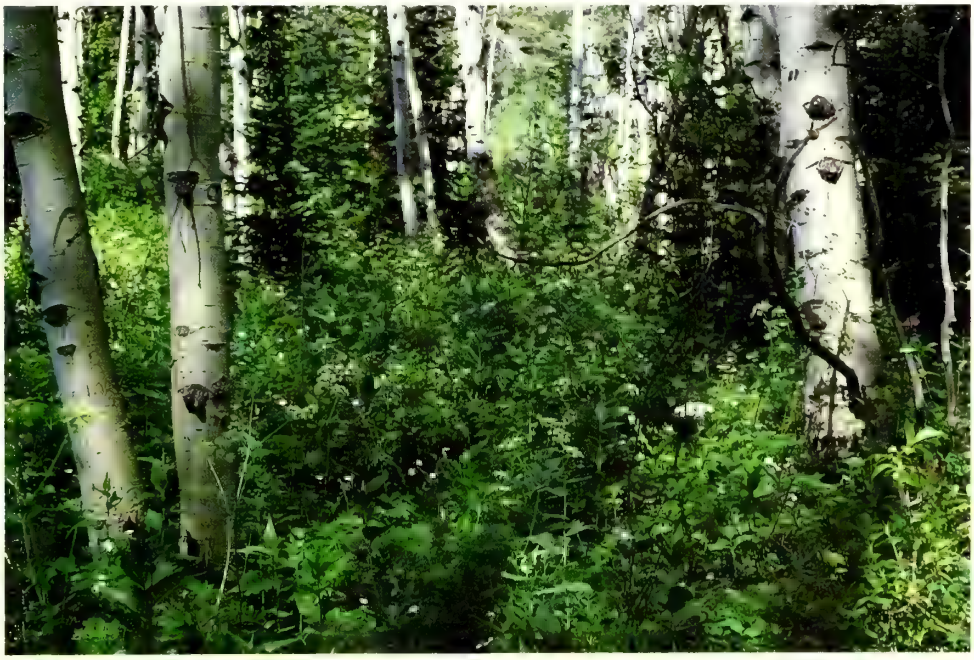

Figure 11—The *Populus tremuloides—Abies lasiocarpa*/Tall Forb c.t. is a seral type in which the aspen overstory is slowly being replaced by *A. lasiocarpa.* As overstory shading increases, productivity of the luxuriant tall forb undergrowth will gradually diminish.

dominated by *T. officinale* and *Poa pratensis* or even eventual replacement of the perennial herbs by such annuals as *N. breviflora, C. linearis,* and *Galium bifolium.*

Production—The ability of this type to produce trees appears to be just slightly better than average. Total basal area on the 17 sites sampled for production averaged 169 ft^2/acre (38.9 m^2/ha), which was just barely within the upper third percentile. An average 28 percent of this basal area consisted of conifers, primarily *A. lasiocarpa*. The remainder was aspen. Two-thirds of the stands can be expected to have between 107 and 231 ft^2/acre (24.6 and 53.0 m^2/ha) tree basal area. Site index for aspen at 80 years averaged 55 ft (16.1 m), with two-thirds of the stands in the type expected to fall between 45 and 65 ft (13.7 and 19.8 m). Volume growth for aspen also is just slightly better than average at 45 ft^3/acre/year (3.2 m^3/ha/year) at stand maturity. Two-thirds of the stands can be expected to produce between 32 and 58 ft^3/acre/year (2.2 and 4.1 m^3/ha/year). Aspen reproduction in these stands averaged 2,688 suckers/acre (6,641/ha), which was in the upper 25 percent of all stands sampled in the Region. The number of aspen trees per acre was about average for all stands at 550 stems/acre (1,359/ha), with two-thirds of the stands expected to have between 264 and 836/acre (654 and 2,066/ha). Conifer reproduction, on the other hand, averaged 609 established seedlings/acre (1,505/ha), 98 percent of which were *A. lasiocarpa*.

Undergrowth productivity appears to be moderate. The average air-dry annual production of undergrowth was 917 lb/acre (1,028 kg/ha), which was about average for all stands. The variability in this production, however, was such that two-thirds of the stands in the type should produce between 388 and 1,446 lb/acre (435 and 1,620 kg/ha). The amount of undergrowth in this seral type diminishes greatly as conifers increase. Harper (1973) observed that undergrowth production in aspen stands was cut in half when conifers increased to approximately 20 ft^2/acre (4.6 m^2/ha). Therefore, by the time conifer invasion accounts for 10 percent of the tree basal area, undergrowth production is probably being reduced appreciably. Undergrowth production is usually dominated by forbs, which were 77 percent of the total. Shrubs are a minor part of this total, averaging only 5 percent. The remaining 18 percent consists of graminoids. The quality of this undergrowth as livestock forage was in the lower third of all stands sampled, with only 43 percent considered desirable and 30 percent of intermediate suitability.

Overall, then, the POTR-ABLA/TALL FORB c.t. is only moderately productive of wood fiber and only moderately valuable as summer range for livestock, when compared to the aspen forests of the whole Region. The process of succession to conifers would render long-term grazing values transitory. The grazing values are probably greater for sheep than for cattle because of the abundance of forbs and relative scarcity of grasses. The undergrowth is less diverse than most of the other types in which the tall forbs are an important undergrowth component. It thus is of less value as habitat for ground-dwelling wildlife. However, the mixture of aspen and conifers in the tree layer should enhance the type's value as habitat for birds.

Other—This seral type was recognized in previous classifications, but the naming of the type differed. The POTR-ABLA/TALL FORB type replaces the name for communities within the *Populus tremuloides—Abies lasiocarpa / Senecio serra* type name used in the Utah aspen classification (Mueggler and Campbell 1986). Communities within both the *P. tremuloides—A. lasiocarpa / Rudbeckia occidentalis* and *P. tremuloides—A. lasiocarpa / Ligusticum filicinum* c.t.'s, and a minor part of those in the *P. tremuloides—A. lasiocarpa / Arnica cordifolia* c.t., identified in the Bridger-Teton National Forest classification (Youngblood and Mueggler 1981), are now within the POTR-ABLA/TALL FORB c.t. The type was not recognized per se in the Caribou and Targhee National Forests classification (Mueggler and Campbell 1982).

Aspen types successional to *Abies lasiocarpa* forests are common in other parts of the Rocky Mountain States (Johnston and Hendzel 1985). Although this particular type has not been specifically identified elsewhere, Johnston and Hendzel (1985) describe a community in western Colorado that contains a tall forb component, lacks a shrub layer, and is successional to *A. lasiocarpa*.

Populus tremuloides/Calamagrostis rubescens Community Type (POTR/CARU c.t.)

Distribution—This is a relatively common type in the northern half of the Region, particularly in eastern Idaho and western Wyoming. Approximately 18 percent of the aspen stands encountered on the Targhee National Forest, 10 percent on the Caribou, and 12 percent on the Bridger-Teton were of this community type. It is especially common in the Centennial Mountains of Idaho and on the Gros Ventre Range of western Wyoming. The type also occurs, though less frequently, in northern and central Utah on the Ashley, Wasatch-Cache, Uinta, and Manti-LaSal National Forests. Occasional stands were as far south as the LaSal and Abajo Mountains in southeastern Utah. It was not observed in Nevada.

Although this type occurs over a wide range of elevations, approximately three-fourths of the 90 stands sampled grew at elevations below 8,000 ft (2,440 m). This no doubt reflects the distribution in the northern part of the Region where most of the aspen is found below about 8,500 ft (2,600 m) elevation. The type occupies slopes and benches irrespective of aspect or slope configuration. Although found on all types of soils, almost half the stands grew on soils derived from sandstone.

Vegetation—The vegetation of this major community type is comparatively simple both in structure and in composition. Most of the time, *Populus tremuloides* is the only tree in the overstory. Conifers, if present, are only incidental. Shrubs such as *Symphoricarpos oreophilus, Rosa woodsii, Amelanchier alnifolia,* and *Juniperus communis* may be present but never in sufficient abundance to form a distinct layer. The undergrowth, therefore, is principally herbaceous species. The type is characterized by the prominence of either *Calamagrostis rubescens* or

Carex geyeri in the undergrowth, the absence of a distinct layer of either low or tall shrubs, and the lack of a substantial element of conifers in the tree layer. Most often the undergrowth has an overall aspect of graminoid (fig. 12). Along with *C. rubescens* and *C. geyeri*, common graminoids are *Agropyron trachycaulum, Bromus carinatus, Elymus glaucus,* and *Poa pratensis*. Occasionally *Stipa occidentalis* or *Poa nervosa* will be abundant. Forbs, usually low growing, are always present and are sometimes abundant. The most likely encountered forbs are *Thalictrum fendleri, Geranium viscosissimum, Lupinus argenteus, Osmorhiza chilensis, Fragaria vesca,* and *Achillea lanulosa*. Where grazing has been heavy, *Astragalus miser* and *Taraxacum officinale* may be abundant. Annuals are never abundant.

Succession—The POTR/CARU c.t. is believed to represent, basically, a climax plant association but often with considerable alteration of community composition because of grazing. However, the occasional presence of conifer regeneration suggests that in some cases a community in this type might be slowly successional to conifer dominance. The conifer species most likely to replace the aspen in this type are *Pseudotsuga menziesii, Pinus contorta,* or possibly *Abies lasiocarpa*. Thus, some stands within this type might be considered successional to either the *Populus tremuloides—Pseudotsuga menziesii / Calamagrostis* c.t., the *P. tremuloides—Pinus contorta / Carex geyeri* c.t., or possibly the *P. tremuloides—Abies lasiocarpa / Carex geyeri* c.t. Changes in community composition likely because of abusive grazing will be an increase in the abundance of *P. pratensis, T. officinale, A. miser,* and possibly *Lathyrus* spp. as the less grazing-tolerant forage species are reduced.

Production—The potential of this type for the production of wood fiber appears to be about average for aspen communities in the Region. Total tree basal area for the 26 stands sampled for production averaged 160 ft^2/acre (36.7 m^2/ha), with two-thirds of the stands expected to produce between 104 and 216 ft^2/acre (23.9 and 49.6 m^2/ha). Conifers averaged only 1 percent of this production. Site index at 80 years for aspen averaged 51 ft (15.5 m), with variance such that two-thirds of the stands can be expected to have site indices between 41 and 61 ft (12.5 and 18.6 m). Volume production of aspen at stand maturity averaged 40 ft^3/acre/year (2.8 m^3/ha/year). Two-thirds of the stands should produce between 27 and 53 ft^3/acre/year (1.9 and 3.7 m^3/ha/year). Aspen sucker reproduction was fairly good, with numbers averaging 2,107/acre (5,207/ha). These were about equally divided between small and large suckers. The total number of aspen trees was also above average for aspen forests as a whole, with 976 stems/acre (2,411/ha). These numbers were highly variable, however, with as many as 4,279/acre (10,572/ha) observed.

Annual production of undergrowth is also within the middle range of all aspen stands. Total air-dry herbage averaged 973 lb/acre (1,090 kg/ha), with two-thirds of the stands expected to produce somewhere between 579 and 1,367 lb/acre (648 and 1,531 kg/ha). The major part of this undergrowth, 59 percent, consisted of graminoids, with most of the rest forbs, 39 percent. Shrub production was a minimal 2 percent. A high 67 percent of the

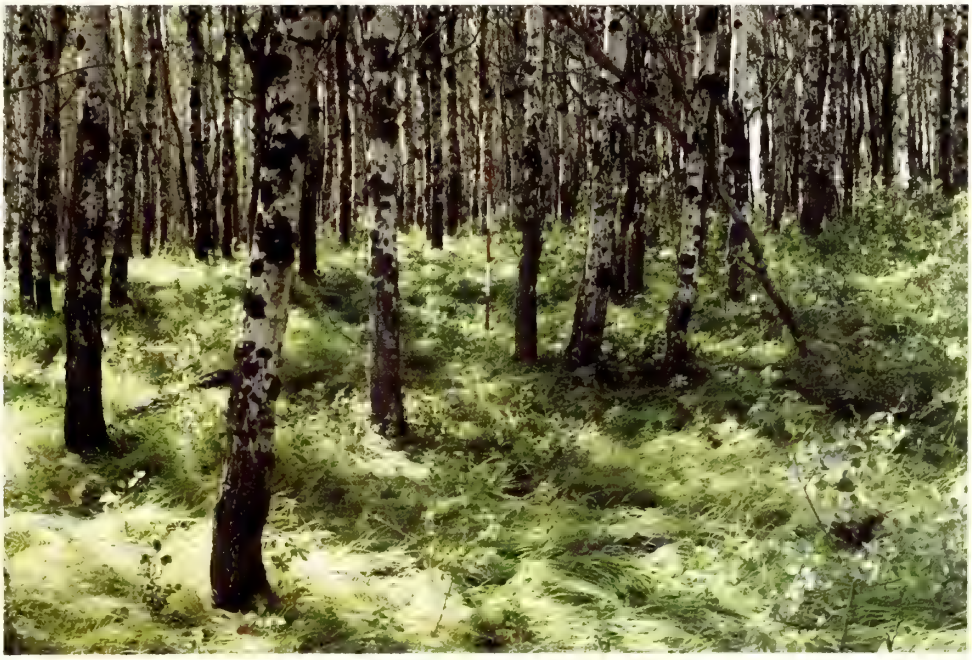

Figure 12—The *Populus tremuloides/Calamagrostis rubescens* c.t., common in eastern Idaho and western Wyoming, is characterized by undergrowth that is simple in both structure and composition. It is dominated primarily by graminoids, either *C. rubescens* or *Carex geyeri*. This stand occurs in the Fall River area east of Ashton, ID.

undergrowth production consisted of desirable forage, which was in the upper 10 percent of all stands sampled. A total of 31 percent was classified as intermediately desirable and only 2 percent as least desirable.

The POTR/CARU c.t. thus appears to be moderately productive of both wood fiber and forage. The large proportion of undergrowth consisting of graminoids suggests that the type is better suited as summer range for cattle than for sheep. The paucity of shrubs in the undergrowth and the scarcity of conifers mixed with the aspen overstory result in poor structural diversity. This lack, combined with generally low species diversity, indicate comparatively low value of the type as wildlife habitat.

Other—Stands of this composition were identified as POTR/CARU c.t.'s both in the Bridger-Teton National Forest classification (Youngblood and Mueggler 1981) and in the Caribou and Targhee National Forests classification (Mueggler and Campbell 1982). The latter classification, however, also contained a category labeled *Populus tremuloides / Calamagrostis rubescens—Poa pratensis,* which is now included in the POTR/CARU c.t. The Utah aspen classification (Mueggler and Campbell 1986) was less definitive than the current classification by including not only *Calamagrostis rubescens* and *Carex geyeri* in the same species guild but *Carex rossii* as well. Additional field experience suggested that *C. rossii* should be treated separately. Therefore, the major part of the aspen stands classified as *P. tremuloides / Carex geyeri* in the Utah classification are now included in the POTR/CARU c.t., and most of the remainder have been placed in a new POTR/CARO c.t. It becomes a bit awkward to use the *C. rubescens* epithet (which includes *C. geyeri*) in the type name in the southern portion of the Region where *C. rubescens* is scarce. But only a few stands of this type occur here so the inconsistency should not be overly discomforting.

Aspen communities with similar composition have been observed in southeastern Wyoming, and in western and central Colorado. Alexander and others (1986) separately identified *Populus tremuloides / Calamagrostis rubescens* and *P. tremuloides / Carex geyeri* habitat types on the Medicine Bow National Forest, both of which would be included in our POTR/CARU c.t. About three-fourths of the stands in Hoffman and Alexander's (1983) *P. tremuloides / C. geyeri* habitat type on the White River National Forest, and all of the stands in Hess and Alexander's (1986) *P. tremuloides / C. geyeri* habitat type on the Arapaho and Roosevelt National Forests, would be included in our POTR/CARU c.t.

Populus tremuloides/Symphoricarpos oreophilus/Calamagrostis rubescens Community Type (POTR/SYOR/CARU c.t.)

Distribution—The POTR/SYOR/CARU c.t. is one of the more prominent types in the Region, especially in the northern half. Of the 88 stands sampled in this type, two-thirds were in eastern Idaho and western Wyoming. It is the second most frequent type on the Caribou National Forest. The type is also common in the Uinta Mountains and occurs in the LaSal and Abajo Mountains of southeastern Utah. A single stand of this type was seen in the Independence Mountains of northeastern Nevada. It was not observed on the high plateaus of southern Utah.

Most of the stands were on shallow to moderately steep slopes and were not limited by exposure or slope configuration. However, no stands were found along stream bottoms. Almost two-thirds of the stands grew on soils derived from sedimentary parent materials, primarily sandstones.

Vegetation—The undergrowth vegetation of this type is much less complex than that in the POTR/SYOR/TALL FORB c.t. Both types have three strata, but the herbaceous undergrowth in this type is comparatively simple and dominated by graminoids. Most of the stands lack conifers in the tree layer. A low shrub layer is prominent and is usually dominated by *Symphoricarpos oreophilus,* but *Rosa woodsii, Pachystima myrsinites*, or *Symphoricarpos albus* may also be abundant. The tall shrubs *Amelanchier alnifolia* and *Prunus virginiana* are frequently present but are never abundant. The herbaceous undergrowth is similar to that found in the POTR/CARU c.t. The prominence of either *Calamagrostis rubescens* or *Carex geyeri* are indicators of this type (fig. 13). Both these species appear to occupy similar environmental situations in the aspen ecosystem and are therefore considered here as ecological equivalents. Other graminoids frequently abundant are *Elymus glaucus*, *Agropyron trachycaulum,* and *Poa pratensis***.** These graminoids are accompanied by various amounts of low-growing forbs, the most common being *Geranium viscosissimum, Lupinus argenteus, Thalictrum fendleri,* and *Osmorhiza chilensis.* Ordinarily, there are few annuals.

Succession—This type appears to be essentially a stable or climax aspen community type. However, about a third of the sampled stands had a few conifers in the overstory or as reproduction, and given sufficient time these may come to dominate the tree strata. Most common were *Pseudotsuga menziesii, Abies lasiocarpa,* and *Pinus contorta.* Conceivably, then, some of the stands in this type could be seral stages within either the *P. menziesii* or *A. lasiocarpa* conifer series. These stands are most likely to be seral to the POTR-PSME/SYOR c.t. or to the POTR-PICO/SYOR c.t. Prolonged overgrazing of the POTR/SYOR/CARU c.t. will probably shift undergrowth composition away from *S. oreophilus* and palatable grasses and forbs and toward *P. pratensis, Taraxacum officinale,* and low-growing, relatively unpalatable forbs.

Production—This community type has a moderate potential for the production of wood and a considerably above average potential for the production of forage. The total basal area of trees averaged 155 ft^2/acre (35.6 m^2/ha) over the 20 stands sampled for production. This figure fell within the mid-third range of all aspen stands sampled in the Region. Basal area production varied appreciably. Two-thirds of the stands can be expected to have basal areas between 101 and 209 ft^2/acre (23.2 and 48.0 m^2/ha). Virtually all of this was aspen. Site index at 80 years for aspen averaged 53 ft (16.1 m), which again was in the mid-third range of all stands. Two-thirds of all

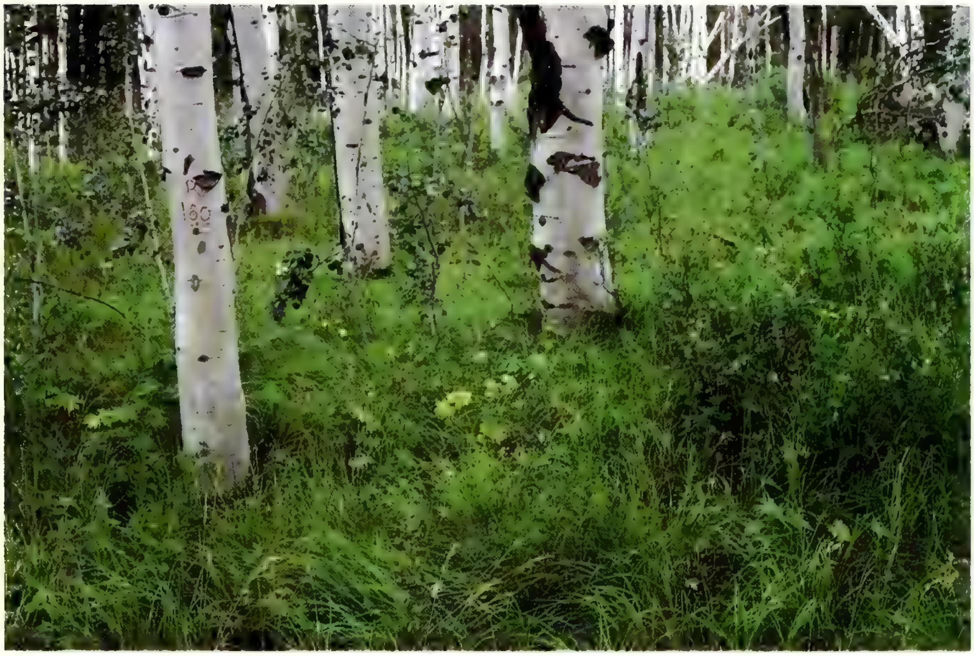

Figure 13—The *Populus tremuloides/Symphoricarpos oreophilus/Calamagrostis rubescens* c.t. is similar to the POTR/CARU c.t. except it contains a layer of low shrubs usually dominated by *S. oreophilus, Pachystima myrsinites,* or *Rosa woodsii.* This is the second most common aspen type on the Caribou National Forest in eastern Idaho.

stands will probably have site indices between 43 and 63 ft (13.1 and 19.2 m). Volume production at stand maturity averaged a moderate 43 ft^3/acre/year (3.0 m^3/ha/year). Two-thirds of the stands in the type should produce between 30 and 56 ft^3/acre/year (2.1 and 3.9 m^3/ha/year). Aspen reproduction averaged in the upper quarter of all stands sampled at 2,055 suckers/acre (5,078/ha). Over half of these exceeded 1 ft (0.3 m) in height. Tree numbers were highly variable between stands. Aspen stems averaged 1,182/acre (2,920/ha), which was in the upper quarter percentile of all stands.

Total annual production of undergrowth averaged 1,309 lb/acre (1,467 kg/ha), which was in the upper quarter of all aspen stands sampled in the Region. Two-thirds of all stands within this type should produce somewhere between 713 and 1,905 lb/acre (799 and 2,134 kg/ha). Graminoids and forbs shared about equally in the composition of undergrowth at 47 and 42 percent, respectively. Shrubs were an average 11 percent. Suitability of the undergrowth as forage ranked fairly high, with 57 percent in the desirable class and 41 percent as intermediate.

The POTR/SYOR/CARU c.t., therefore, is fairly good summer range for livestock, although it is probably better suited for cattle than for sheep because of the abundance of graminoids in the undergrowth. The lack of a tall shrub stratum and the general absence of conifers in the overstory reduce structural diversity and somewhat diminish the value of the type as wildlife habitat.

Other—In earlier aspen classifications, stands now included in the POTR/SYOR/CARU c.t. were treated differently. All stands placed in the *Populus tremuloides / Symphoricarpos oreophilus—Calamagrostis rubescens* c.t., the *P. tremuloides / Pachystima myrsinites—C. rubescens* c.t., and in the *P. tremuloides / Spiraea betulifolia—C. rubescens* c.t. under the Caribou and Targhee National Forests classification (Mueggler and Campbell 1982) are now included in the POTR/SYOR/CARU c.t. Part of the stands included in the Utah classification (Mueggler and Campbell 1986) as the *P. tremuloides / S. oreophilus / Carex geyeri* c.t., and a minor part of those in the *P. tremuloides / S. betulifolia* c.t. of the Bridger-Teton National Forest classification (Youngblood and Mueggler 1981), are now classified as POTR/SYOR/CARU c.t. The current arrangement more clearly represents meaningful differences in composition and avoids unwarranted splitting.

Communities similar to this type appear in western Colorado. Approximately two-thirds of the stands that Hoffman and Alexander (1983) placed in the generalized *P. tremuloides / S. oreophilus* habitat type on the White River National Forest are comparable to our POTR/SYOR/CARU c.t.

Populus tremuloides/Amelanchier alnifolia—Symphoricarpos oreophilus/ Calamagrostis rubescens Community Type (POTR/AMAL-SYOR/CARU c.t.)

Distribution— Although this major type accounted for only 3 percent of all aspen communities Region-wide, it is important in the northern part. It was the most frequent type on the Targhee National Forest, accounting for 22 percent of the aspen communities, and on the Caribou National Forest where it was 15 percent. A few stands were on the Bear River Range and on the west end of the Uinta Mountains in northern Utah. The type was not encountered farther south in Utah nor was it seen in Nevada.

The POTR/AMAL-SYOR/CARU c.t. is a relatively low elevation type; 85 percent of the stands were at less than 7,000 ft (2,100 m). A fairly high proportion of these stands were on southerly and westerly slopes, some of which exceeded 50 percent steepness. Although they grew on a wide variety of soils, almost half occupied soils derived from sandstone parent materials.

Vegetation—The vegetation of this major community type is described on the basis of 68 stands. The tree layer consists almost exclusively of *Populus tremuloides*, except for about a third of the stands where conifers, primarily *Pseudotsuga menziesii*, are present in small amounts. The undergrowth is multistructured. A tall shrub stratum exists that is usually dominated by either *Amelanchier alnifolia* or *Prunus virginiana*. Occasionally *Acer grandidentatum* is abundant. The tall shrub layer frequently is broken and ill defined, but total canopy cover of these species generally exceeds 10 percent. The low shrub stratum is usually dominated by either *Symphoricarpos oreophilus* or *Symphoricarpos albus*. Frequently, *Pachystima myrsinites*, and occasionally *Spiraea betulifolia*, are abundant. *Berberis repens* is often common. The undergrowth is characterized by the presence of these two shrub strata and an herbaceous layer in which *Calamagrostis rubescens* and sometimes *Carex geyeri* are prominent (fig. 14). The only other graminoid that has high constancy is *Elymus glaucus*. Low forbs generally form an important part of the community. The most common and conspicuous of these are *Thalictrum fendleri, Geranium viscosissimum, Lupinus argenteus*, and *Osmorhiza chilensis*. Members of the tall forb complex are absent or incidental in this type. Although a variety of annuals may be present, they are seldom abundant.

Succession—The POTR/AMAL-SYOR/CARU c.t. is primarily a stable or climax community type. Those stands containing *P. menziesii* reproduction may eventually succeed to dominance by this conifer, but such succession is likely to be slow. Where this occurs, the stand should be considered a seral stage within the *P. menziesii* climax series, probably through the *Populus tremuloides—Pseudotsuga menziesii / Amelanchier anifolia* c.t. enroute to the *P. menziesii / Osmorhiza chilensis* habitat type (Mauk and Henderson 1984; Steele and others 1983). Abusive livestock grazing in this type will probably lead to a decrease in the abundance of *Symphoricarpos* spp. and other palatable shrubs and a shift in composition away from the more palatable and grazing-sensitive herbs and toward increased amounts of *Poa pratensis, Achillea millefolium, Arnica cordifolia*, and *Taraxacum officinale*.

Production—As with the related POTR/SYOR/CARU c.t., this type is only moderately productive of wood but above average in the production of forage. A total of 32 stands were sampled for production. Total tree basal area averaged 117 ft^2/acre (26.9 m^2/ha), all but 1 percent of which was aspen. This was in the lower third percentile of the aspen stands in the Region. Two-thirds of all stands in this type can be expected to have basal areas

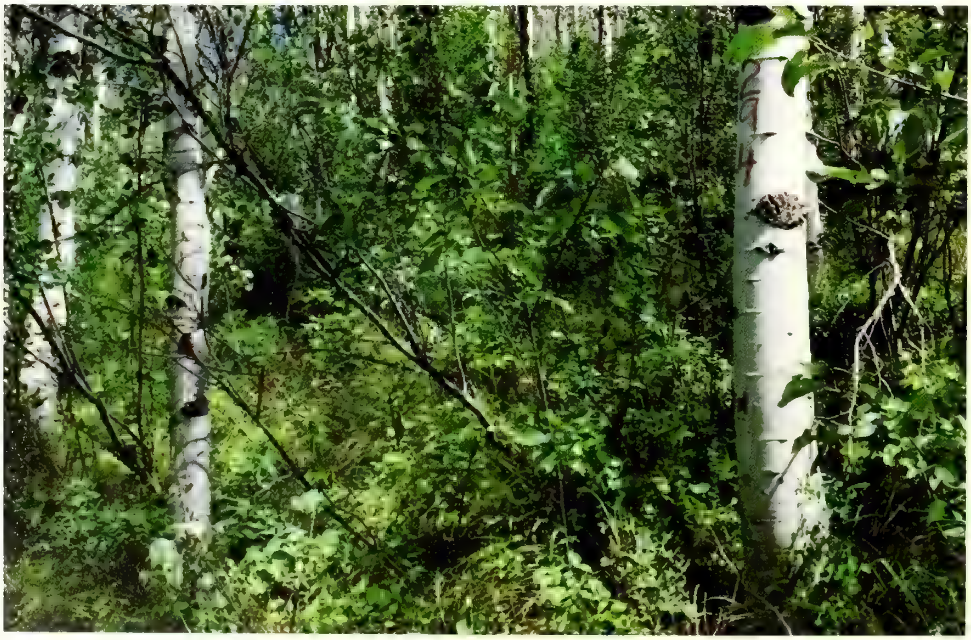

Figure 14—The undergrowth of the *Populus tremuloides/Amelanchier alnifolia—Symphoricarpos oreophilus/Calamagrostis rubescens* c.t. is characterized by the presence of three strata: tall shrubs, low shrubs, and an herbaceous layer in which *C. rubescens* or *Carex geyeri* are prominent graminoids. The type is most commonly encountered on the Targhee and Caribou National Forests in eastern Idaho.

between 84 and 150 ft^2/acre (19.3 and 34.4 m^2/ha). Site index for aspen at 80 years averaged 49 ft (14.9 m) and at maturity would produce 38 ft^3/acre/year (2.6 m^3/ha/year). Both these productivity measures ranked in the mid-third of all aspen stands. Two-thirds of all stands in the type could be expected to have site indices between 40 and 58 ft (12.2 and 17.7 m) and volume production between 26 and 50 ft^3/acre/year (1.8 and 3.5 m^3/ha/year). Aspen reproduction averaged a moderate 1,241 suckers/acre (2,804/ha). Tree stems were also moderately numerous with an average 788 trees/acre (1,947/ha). Two-thirds of the stands are expected to have somewhere between 225 and 1,351 stems/acre (556 and 3,338/ha).

Annual production of air-dry undergrowth averaged 1,107 lb/acre (1,241 kg/ha), which was in the upper third percentile of all stands. Two-thirds of the stands can be expected to produce somewhere between 502 and 1,712 lb/acre (562 and 1,917 kg/ha). Composition averaged 39 percent graminoids, 33 percent forbs, and 28 percent shrubs. A high proportion of the undergrowth, 59 percent, was classified as desirable forage, and 39 percent was noted as intermediate. The generally high production of undergrowth combined with relatively high palatability translates into productive livestock range.

As with the other community types in which *C. rubescens* is the typal herbaceous indicator, the POTR/AMAL-SYOR/CARU c.t. is moderately productive of wood fiber and above average in total undergrowth production but is less productive of herbaceous undergrowth than either the POTR/SYOR/CARU or POTR/CARU types. Annual production of shrubs is more than twice as great in the POTR/AMAL-SYOR/CARU c.t. than either of the others. Thus, the ample production of graminoids, forbs, and shrubs, as well as the good structural diversity created by the abundance of both tall and low shrubs beneath the aspen canopy, makes this type not only better than average summer range for livestock but considerably above average habitat for wildlife as well.

Other—Stands now contained within this type were included under various names in earlier preliminary classifications. Most of the stands placed in the *Populus tremuloides / Prunus virginiana / Carex geyeri* c.t. of the Utah classification (Mueggler and Campbell 1986) and in the *P. tremuloides / P. virginiana* and *P. tremuloides / Spiraea betulifolia* c.t.'s in the Bridger-Teton National Forest classification (Youngblood and Mueggler 1981) are now in the POTR/AMAL-SYOR/CARU c.t. All stands formerly within the *P. tremuloides / Amelanchier alnifolia—Pachystima myrsinites* and *P. tremuloides / A. alnifolia— S. betulifolia* c.t.'s, and most of those in the *P. tremuloides / A. alnifolia— S. oreophilus* c.t., of the Caribou and Targhee National Forests classification (Mueggler and Campbell 1982), are now placed in this community type. This new arrangement, based upon a larger sample and improved insight, is more realistic than the previous placements.

Stands similar to these, with both a tall shrub and low shrub layer underlain by either *C. geyeri* or *C. rubescens*, have been observed in western Colorado. A small number of the stands included in the *P. tremuloides / S. oreophilus* habitat type reported for the White River National Forest by Hoffman and Alexander (1983) fit this description.

Populus tremuloides/Thalictrum fendleri Community Type (POTR/THFE c.t.)

Distribution—The POTR/THFE c.t. comprised almost 5 percent of the aspen stands within the study area. It occurred on all Forests except the Toiyabe but was most frequent on the northern Forests. It was the most common type on the Bridger-Teton National Forest where it comprised approximately 12 percent of the aspen stands. The type made up 18 percent of the stands on the Targhee, 10 percent of those on the Caribou, and 7 percent of those on the Ashley (appendix C). It occurred on the Santa Rosa, Independence, Jarbidge, East Humboldt, Ruby, and Schell Creek Ranges where it comprised 8 percent of all aspen communities on the Humboldt National Forest.

The type occurred over a wide range of elevations, from 5,700 ft (1,740 m) on the Targhee National Forest to 10,500 ft (3,200 m) on the Manti-LaSal. Over half the stands sampled, however, were within the 7,000 to 9,000 ft (2,100 to 2,700 m) elevational zone. Over two-thirds of the stands grew on straight to concave slopes at mid and lower slope positions. Neither direction of slope nor soil parent material appeared restrictive.

Vegetation—The vegetation of this type is essentially two-layered: a tree stratum usually of only *Populus tremuloides*, and a low-herb stratum (fig. 15). An occasional conifer, usually *Abies lasiocarpa* but sometimes *Pseudotsuga menziesii* or *Pinus contorta*, may be present in the tree stratum but is never abundant. Although a well-defined shrub layer is lacking, small amounts of shrubs may be present, particularly *Symphoricarpos oreophilus, Rosa woodsii,* and *Berberis repens*. The type is characterized by the absence of substantial amounts of conifers in the tree layer, the absence of a distinct shrub layer, the absence of appreciable quantities of either *Calamagrostis rubescens* or *Carex geyeri*, and the prominence of either *Thalictrum fendleri, Geranium viscosissimum*, or *Osmorhiza chilensis* in the undergrowth. Other forbs frequently present in substantial amounts include *Lupinus argenteus, Fragaria vesca,* and *Achillea millefolium*. Grasses that are common and often abundant are *Bromus carinatus, Elymus glaucus,* and *Agropyron trachycaulum*. A wide variety of annuals may be present, but they are seldom abundant except for some of the stands in northern Nevada.

Succession—Most of the stands within this community type are believed to represent stable aspen situations. However, the successional status of the vegetation with respect to grazing alteration is uncertain. Abusive grazing has led first to an increase in the abundance of such grasses as *Poa pratensis* and perhaps *Stipa occidentalis*, and such forbs as *Taraxacum officinale, A. millefolium, Astragalus miser*, and perhaps *F. vesca* and *Arnica cordifolia* at the expense of the less grazing-resistant forbs. Extreme and continued abusive grazing will likely result in an appreciable increase in such annuals as *Nemophila breviflora, Galium bifolium*, and *Collomia linearis* and a reduction in the perennial grasses and forbs. This situation appears to have occurred in some of the

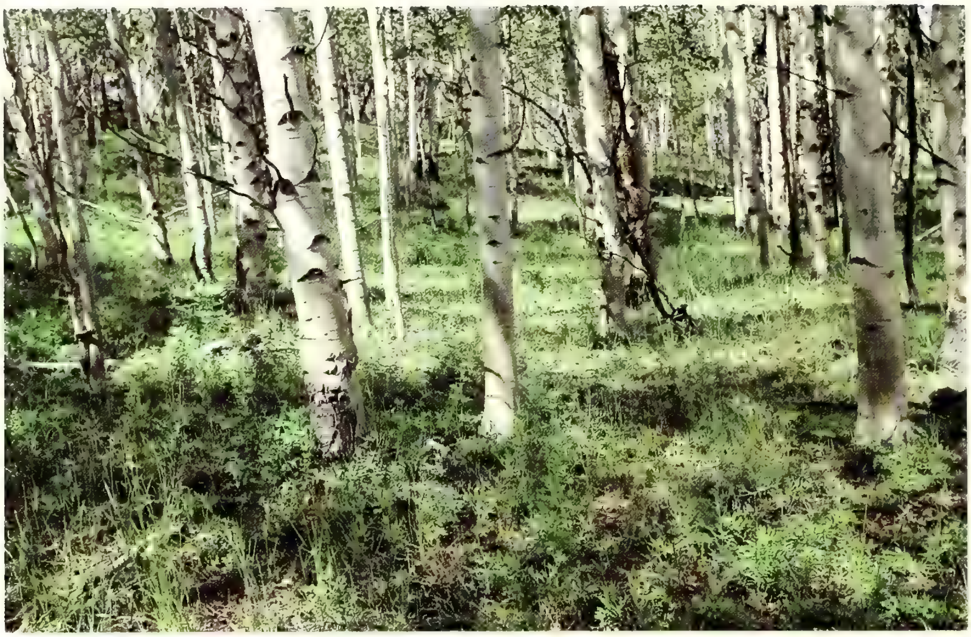

Figure 15—Although widespread, the structurally simple *Populus tremuloides/Thalictrum fendleri* c.t. is the most common on the Bridger-Teton National Forest in western Wyoming. The undergrowth principally comprises low-growing forbs, of which *T. fendleri, Geranium viscosissimum,* or *Osmorhiza chilensis* are usually prominent.

communities in Nevada. In about a third of the stands in this community type, *Abies lasiocarpa* was present either as an incidental member of the tree layer or as tree reproduction. Conceivably, these stands could be slowly successional to conifer dominance in the *A. lasiocarpa* forest series. Most likely they would succeed to the *Populus tremuloides—Abies lasiocarpa / Thalictrum fendleri* c.t., which appears to be successionally related to the *A. lasiocarpa / Osmorhiza chilensis* habitat type (appendix E).

Production—The type appears to be fairly well suited for the growing of trees, with an average of 169 ft²/acre (38.7 m²/ha) of basal area on the 24 stands sampled for production. This ranked in the upper third of all stands sampled in the Region. An average 11 percent of this basal area consisted of conifers. The variance in basal area was such that two-thirds of the stands should have between 112 and 226 ft²/acre (25.7 and 51.9 m²/ha). Site index for aspen and anticipated volume production were a moderate 47 ft (14.4 m) and 36 ft³/acre/year (2.5 m³/ha/year), respectively. Two-thirds of the aspen stands should have a site index between 36 and 58 ft (11.0 and 17.7 m) and volume production at stand maturity between 21 and 51 ft³/acre/year (1.5 and 3.6 m³/ha/year). Aspen sucker reproduction averaged in the upper third percentile of all stands at 1,715/acre (4,238/ha). Over half of these were in the larger size class. The average number of tree stems was in the upper quarter percentile of all stands at 1,084/acre (2,678/ha).

The annual production of undergrowth, 696 lb/acre (781 kg/ha), was slightly less than average for all stands in the Region. Two-thirds of the stands can be expected to produce between 260 and 1,132 lb/acre (291 and 1,268 kg/ha). The bulk of this undergrowth consisted of forbs, an average of 59 percent, with 32 percent of the production in graminoids and 9 percent in shrubs. Suitability of the undergrowth as forage was about average for all aspen stands, with 49 percent classified as desirable, 38 percent as intermediate, and a rather high 13 percent as least desirable.

The overall lack of diversity in vegetation structure, with the absence of shrub strata, tends to reduce the value of the POTR/THFE c.t. as wildlife habitat. The type is of moderate value as summer range for livestock, particularly for sheep, and of moderate value for the production of wood fiber.

Other—During the course of this study, I vacillated over recognition of the uniqueness of communities now placed in the POTR/THFE c.t. and over selection of an appropriate epithet. Initially, in the Bridger-Teton National Forests classification (Youngblood and Mueggler 1981), a restricted type of this composition and name was identified. Later, in the Caribou and Targhee National Forest classification (Mueggler and Campbell 1982), the type was recognized, but the *Geranium viscosissimum* epithet was used in the type name. In the Utah classification (Mueggler and Campbell 1986), they were not identified as a separate community type but were included where they best fit in other types. The current type is broader than that in both the Caribou/Targhee classification and in the Bridger-Teton classification in that it

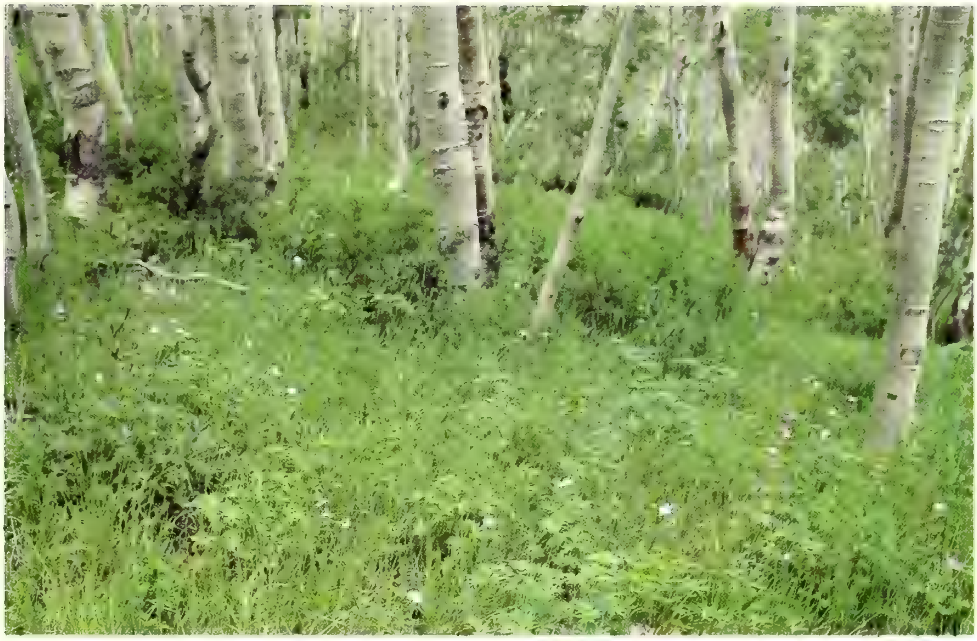

Figure 16—The *Populus tremuloides/Symphoricarpos oreophilus/Thalictrum fendleri* c.t. is widespread throughout the Intermountain Region; it is most common in the mountain ranges of southern Idaho and northern Utah. The undergrowth comprises a layer of low shrubs (primarily *S. oreophilus*, and a low herb layer in which *T. fendleri, Geranium viscosissimum,* or *Osmorhiza chilensis* are prominent.

includes a major portion of the stands in the *Populus tremuloides / Poa pratensis* type of the former, and portions of the *P. tremuloides / Berberis repens, P. tremuloides / Arnica cordifolia,* and *P. tremuloides / Astragalus miser* types of the latter. The current POTR/THFE c.t fills a needed slot in the classification.

Communities similar to this type were observed on the Medicine Bow National Forest in southeastern Wyoming by Alexander and others (1986). Approximately two-thirds of the stands they placed in their *P. tremuloides / T. fendleri* habitat type are of this structure and approximate composition.

Populus tremuloides/Symphoricarpos oreophilus/Thalictrum fendleri Community Type (POTR/SYOR/THFE c.t.)

Distribution—This major community type is widespread throughout the Region and was observed on all National Forests within the study area except the Dixie and Toiyabe. It is most prevalent on the Webster, Bear River, and Wasatch mountain ranges of southern Idaho and northern Utah. It is also a fairly common type in the Santa Rosa, Ruby, and Schell Creek ranges of Nevada. A number of examples of this type appeared as far south as the Abajo Mountains of southeastern Utah.

Elevation extremes of the type range from 5,200 ft (1,600 m) on the Targhee Forest to 8,900 ft (2,700 m) on the Humboldt. Generally, however, it is a low to moderate elevation type with 80 percent of the stands growing between 6,000 and 8,700 ft (1,800 and 2,650 m). Stands generally grew on gentle slopes of less than 25 percent steepness, rather than on benches or flats. They were found on all aspects and on soils derived from both igneous and sedimentary parent materials.

Vegetation—The vegetation structure and undergrowth appearance of this type bear considerable resemblance to that of the POTR/SYOR/CARU c.t. Both types have a low shrub stratum dominated primarily by *Symphoricarpos oreophilus,* plus an abundance of low herbs (fig. 16). The primary difference is the lack of the principal indicator graminoids *Calamagrostis rubescens* or *Carex geyeri,* reduced prominence of the forb *Lupinus argenteus,* and a greater abundance of *Bromus carinatus, Stellaria jamesiana,* and annuals. The primary forbs in the POTR/SYOR/THFE c.t. are usually *Thalictrum fendleri, Geranium viscosissimum, Osmorhiza chilensis, Achillea millefolium,* and *Taraxacum officinale.* Low shrubs in addition to *S. oreophilus* include *Rosa woodsii, Berberis repens,* and *Pachystima myrsinites.* Tall shrubs such as *Amelanchier alnifolia* and *Prunus virginiana* may be present but are never abundant enough to form a distinct stratum. The most common annuals are *Nemophila breviflora* and *Galium bifolium.* Conifers, principally *Abies lasiocarpa* or *Pseudotsuga menziesii,* sometimes occur in this type but form only a very minor part of the tree layer.

Succession—Most of the stands have *Populus tremuloides* as the dominant and apparently climax tree species. Only a few stands have conifers in sufficient amounts to suggest that they may eventually succeed to conifer dominance. In such cases, these stands are successional communities within the *A. lasiocarpa* or *P. menziesii* series of coniferous forest habitat types. Communities in this type probably have been affected considerably by prolonged livestock use. Abusive grazing over many years will likely reduce the amount of such shrubs as *S. oreophilus* and the more palatable grasses and forbs and increase such species as *Poa pratensis, T. officinale, S. jamesiana,* and annuals. Occasionally, *Lathyrus* spp. and *Vicia americana* may be fairly abundant.

Production—Total stand basal area in this type averaged 127 ft^2/acre (29.2 m^2/ha), which is somewhat less than in the closely related POTR/THFE c.t. and is in the low mid-third percentile of all aspen stands sampled. Two-thirds of the stands should have basal areas somewhere between 93 and 161 ft^2/acre (21.4 and 37.0 m^2/ha). An average 94 percent of this basal area is aspen trees. Both site index for aspen and volume production at maturity were about average for all aspen stands. Site index at 80 years averaged 48 ft (14.6 m), with two-thirds of the stands between 38 and 58 ft (11.6 and 17.7 m). Volume production averaged 36 ft^3/acre/year (2.5 m^3/ha/year); two-thirds of the stands should produce between 23 and 49 ft^3/acre/year (1.6 and 3.4 m^3/ha/year). Aspen reproduction was highly variable but averaged a moderate 1,234 suckers/acre (2,871/ha). The average number of trees, 1,162/acre (2,871/ha), ranked in the upper quarter of all aspen stands in the Region but varied tenfold between stands.

The type is moderately productive of undergrowth, averaging 881 lb/acre of air-dry material annually. This fell within the mid-third percentile of all aspen stands within the Region. Two-thirds of the stands should produce somewhere between 528 and 1,234 lb/acre (591 and 1,382 kg/ha). Most of this production consisted of forbs (42 percent) and graminoids (41 percent). The remaining 17 percent consisted of the annual growth of shrubs. This undergrowth is of better than average suitability as forage; 45 percent was classified as desirable, 51 percent intermediate, and the remaining 4 percent as least desirable.

The POTR/SYOR/THFE c.t. thus appears to be no more than moderately productive of wood fiber and of moderate value as summer range for livestock. The composition of the undergrowth suggests that the forage is of about equal value for sheep as it is for cattle. The presence of a shrub stratum enhances the value of this type over that of the POTR/THFE c.t. as habitat for wildlife.

Other—As with the POTR/THFE c.t., separate recognition of a POTR/SYOR/THFE c.t. was fraught with uncertainty in the earlier classifications. All of the stands formerly identified in the *Populus tremuloides / Symphoricarpos oreophilus—Poa pratensis* and *P. tremuloides/ Pachystima myrsinites—Geranium viscosissimum* c.t.'s in the Caribou and Targhee National Forests classification (Mueggler and Campbell 1982) are now included in the POTR/SYOR/THFE c.t. Part of the stands contained in the *P. tremuloides / S. oreophilus, P. tremuloides/Arnica cordifolia,* and *P. tremuloides/Astragalus miser* c.t.'s in the Bridger-Teton classification (Youngblood and Mueggler 1981) are now in this type. And a minor portion of those stands in the *P. tremuloides / S. oreophilus / Carex geyeri* c.t. of the Utah classification (Mueggler and Campbell 1986) has been included in POTR/SYOR/THFE c.t. The current arrangement more satisfactorily reflects the differences apparent in the field.

Stands with this structure and approximate composition were observed in northwestern Colorado by Hoffman and Alexander (1980). Approximately half the stands they placed in their *P. tremuloides/S. oreophilus* habitat type are similar to those in our POTR/SYOR/THFE c.t.

Populus tremuloides /Amelanchier alnifolia—Symphoricarpos oreophilus/ Thalictrum fendleri Community Type (POTR/AMAL-SYOR/THFE c.t.)

Distribution—The POTR/AMAL-SYOR/THFE c.t. is largely concentrated in the northern half of the Region north of 39° latitude. It is most abundant on the Targhee and Caribou National Forests where it accounted for at least 5 percent of the aspen communities. It occurs on all National Forests within the study area except the Manti-LaSal, Dixie, and Toiyabe.

This is a low to moderate elevation community type. Elevations of sampled stands range from 5,800 ft (1,770 m) on the Targhee National Forest in eastern Idaho to 8,100 ft (2,470 m) on the Humboldt in northeastern Nevada. These stands characteristically grew on gentle slopes (less than 25 percent steepness) in a low or mid-slope position. Although encountered on a wide variety of soil parent materials, almost half the stands grew on soils derived from sandstone.

Vegetation—The tree layer of this type consists primarily of *Populus tremuloides. Abies lasiocarpa* or *Pseudotsuga menziesii* are occasionally present but only in small amounts. The undergrowth has a multilayered structure of tall shrubs, low shrubs, and a fairly low-growing layer of herbaceous species (fig. 17). The type is characterized by its lack of conifers in the tree stratum, the presence of both tall and low shrub components, and the lack of significant quantities of both tall forbs and the graminoids *Calamagrostis rubescens* and *Carex geyeri*. As in other types containing an element of tall shrubs, the most common tall shrubs here are *Amelanchier alnifolia* and *Prunus virginiana*. This stratum is frequently open and scattered but overall covers at least 10 percent of the ground surface. Principal species in the low shrub stratum are *Symphoricarpos oreophilus* and *Rosa woodsii*. In a few stands, *S. albus* replaces *S. oreophilus* as the dominant shrub. Other stands have considerable amounts of *Pachystima myrsinites*. The herbaceous undergrowth is dominated primarily by such low-growing species as *Thalictrum fendleri, Geranium viscosissimum, Osmorhiza chilensis,* and *Lupinus argenteus*. Occasional tall forbs, particularly *Agastache urticifolia, Senecio serra* or *Aster engelmannii,* may be present, but they never form a prominent part of the undergrowth. The most commonly encountered and abundant grasses in this type are *Elymus glaucus, Bromus carinatus, Poa pratensis,* and

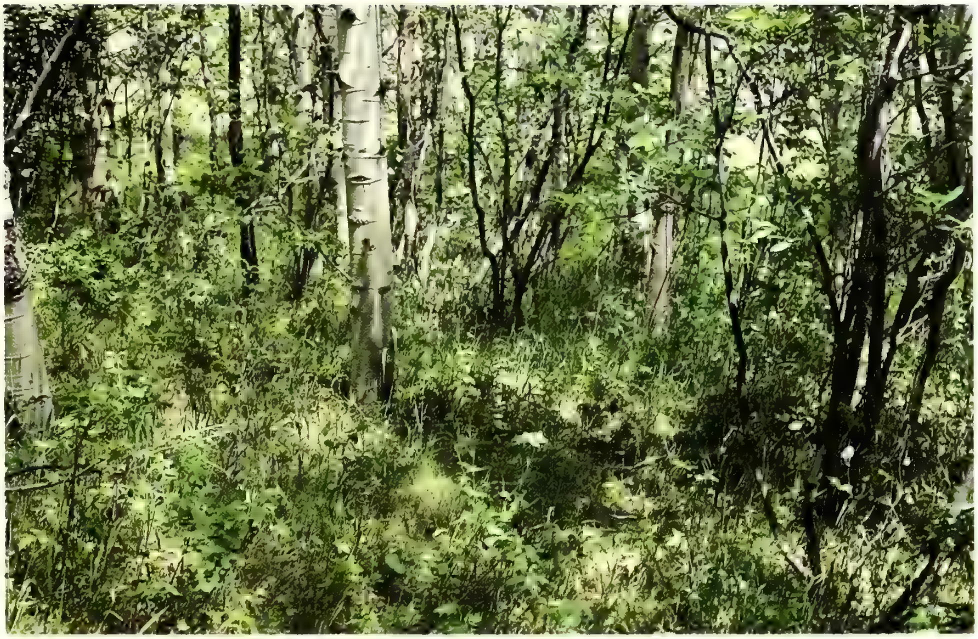

Figure 17—The undergrowth of the *Populus tremuloides/Amelanchier alnifolia—Symphoricarpos oreophilus/Thalictrum fendleri* c.t. is structurally diverse, consisting of tall shrubs,, low shrubs, and an herbaceous stratum in which such low-growing forbs as *T. fendleri, Geranium vicosissimum, Osmorhiza chilensis*, and *Lupinus argenteus* are usually prominent. This primary community type is most abundant in the northern half of the Region.

Agropyron trachycaulum. A variety of annual species may be present but are seldom abundant.

Succession—In most of the stands within this type the aspen overstory appears to be stable. However, in stands where conifers are present, the aspen overstory may eventually give way to either *P. menziesii* or *A. lasiocarpa*. These communities might be considered seral stages within these conifer forest series. In the case of the former, the community could succeed to a *Populus tremuloides—Pseudotsuga menziesii /Amelanchier alnifolia* c.t., which is most likely a seral stage within the *P. menziesii/O. chilensis* habitat type (appendix E). If *A. lasiocarpa* is the invading conifer, the community likely will succeed to a *Populus tremoloides—Abies lasiocarpa / Amelanchier alnifolia* c.t., which probably is a seral stage within the *A. lasiocarpa/Berberis repens* habitat type of northern Utah. The successional status of the undergrowth is difficult to assess. The lack of appreciable amounts of tall forbs may be attributable to either abiotic environment or to grazing influences. If grazing is the cause, then the community type may represent a seral stage leading to a POTR/AMAL-SYOR/TALL FORB climax community type. If not, then the type may reflect response of the vegetation to abiotic environment and represent an aspen habitat type.

Production—Tree production appears to be moderate. Total stand basal area averaged 134 ft^2/acre (30.9 m^2/ha), with two-thirds of the stands in the type expected to fall between 98 and 170 ft^2/acre (22.5 and 31.0 m^2/ha). Aspen made up 98 percent of the basal area. Aspen site index at 80 years averaged a fairly low 43 ft (13.0 m), with a variance placing two-thirds of the stands between 35 and 51 ft (10.7 and 15.5 m). Aspen volume production was equally low. An average 30 ft^3/acre/year (2.1 m^3/ha/year) can be expected at stand maturity, with two-thirds of the stands within the type producing between 19 and 41 ft^3/acre/year (1.3 and 2.9 m^3/ha/year). These averages for both site index and volume production were in the lower third percentile for all aspen stands. Despite low tree productivity, aspen regeneration averaged a relatively high 2,681 suckers/acre (6,624/ha). About three-fourths of these suckers were over 1 ft (0.3 m) high. Tree density was also high, averaging 1,072 stems/acre (2,649/ha), which was in the upper 25 percent of all aspen stands.

Annual production of undergrowth was in the upper third of all aspen stands, averaging 1,099 lb/acre (1,232 kg/ha) of air-dry material. Two-thirds of the stands within this type can be expected to produce somewhere between 603 and 1,595 lb/acre (675 and 1,786 kg/ha). This production was fairly well balanced between graminoids at 37 percent, forbs at 35 percent, and shrubs at 28 percent. Overall forage suitability ranked above average, with 50 percent of the cover classified as desirable and 47 percent as intermediate.

The POTR/AMAL-SYOR/THFE c.t thus appears only moderately productive of wood fiber but above average in the production of livestock forage. The type is well above average as wildlife habitat because of good structural diversity of the vegetation cover. The type is considerably better than either the POTR/THFE or POTR/SYOR/THFE types in this respect because of greater undergrowth production and because this undergrowth consists of a diverse mixture of tall shrubs, low shrubs, and a favorable mixture of forbs and graminoids.

Other—Vegetation similar to this type occurs in northwestern Colorado. Half the stands included in Hoffman and Alexander's (1980) *Populus tremuloides / Symphoricarpos oreophilus* habitat type on the Routt National Forest resemble stands contained in our POTR/AMAL-SYOR/THFE c.t.

Populus tremuloides/Carex rossii Community Type (POTR/CARO c.t.)

Distribution—This major community type is almost exclusively restricted to the southern portion of the Region below 39° latitude. It is by far the most common type on the Toquima and Monitor Ranges of the Toiyabe National Forest where it comprised 54 percent of all stands. It is also abundant on Utah's southern plateaus and is the second most frequently encountered aspen type on the Dixie National Forest (the first is the *Populus tremuloides—Abies lasiocarpa / Carex rossii* c.t.), where it comprises 10 percent of the stands. It makes up 8 percent of the stands on the Fishlake National Forest, where it is especially common on the Sevier and Fishlake Plateaus.

All of the 57 stands sampled to describe this type occurred at elevations over 8,000 ft (2,400 m). The highest elevation was 10,500 ft (3,200 m) on the Sevier Plateau. These high elevations no doubt reflect the relationship between latitude and elevation in the occurrence of aspen forests in the Region. Over 90 percent of aspen communities in southern Utah and Nevada grow at elevations in excess of 8,000 ft (2,400 m) (table 1). The type does best on fairly gentle slopes (less than 25 percent) with straight or concave configuration. Over two-thirds of the stands occurred on such slopes. A total of 80 percent of the stands were on soils of volcanic origin, and another 10 percent were on granitic soils. Thus, the distribution of the type appears to be fairly restricted to soils of igneous parent materials.

Vegetation—This is one of the simplest aspen community types in the Region from the standpoint of both vegetation structure and composition (fig. 18). It is similar to the POTR-ABLA/CARO c.t. except for the amount of *Abies lasiocarpa* sharing the tree stratum with *Populus tremuloides*. Occasionally, *Picea engelmannii* and *Pinus flexilis* are also present but never abundant. Communities within the type are essentially two-layered—trees and graminoids. There are few shrubs or forbs. Although shrubs were present in well over half the 57 stands sampled in this type, they were not prominent enough to form a separate stratum. The most common shrubs are *Symphoricarpos oreophilus*, *Artemisia tridentata*, and *Juniperus communis*. Either *Carex rossii* or *Bromus anomalus*, generally the former, are prominent. Other graminoids commonly encountered are *Stipa occidentalis*, *Poa fendleriana*, and *Agropyron trachycaulum*, but many other species can be observed (appendix F). Forbs are generally scarce and limited to low-growing species. The most common are *Lupinus sericeus*, *Stellaria jamesiana*, and *Taraxacum officinale*. Annual plants are scarce.

Succession—Many of the stands lack evidence of invasion by conifers, and thus they might be considered essentially stable aspen communities. Other stands, however, appear obviously susceptible to such invasion, from *A. lasiocarpa* in particular, and are thus judged to be seral communities. The direction of succession for these latter communities would be from the POTR/CARO c.t. to the

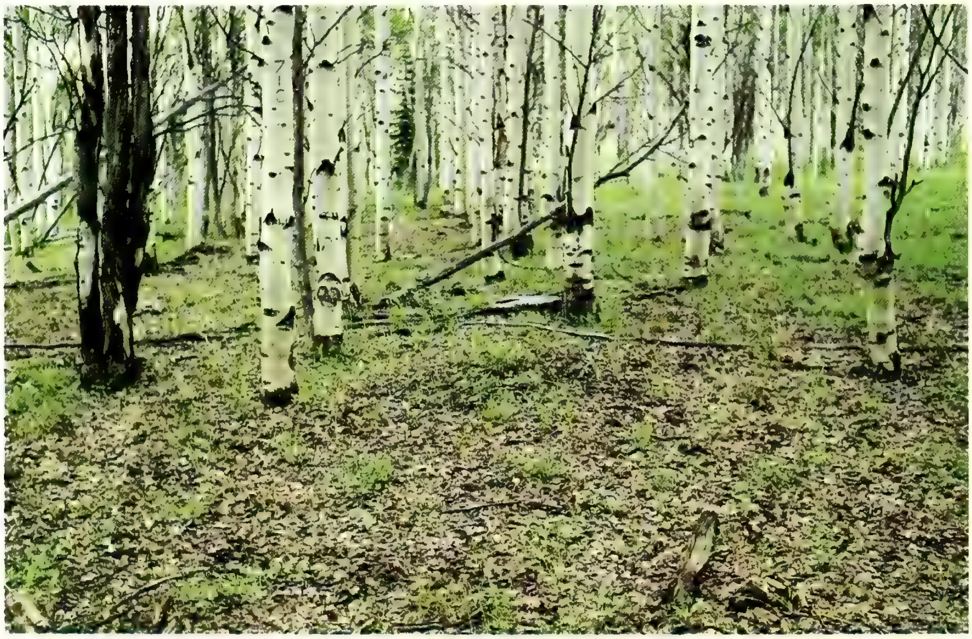

Figure 18—The *Populus tremuloides/Carex rossii* c.t. is common in the southern half of the Region in both Utah and Nevada. The undergrowth, which is both structurally and compositionally simple, generally consists of a sparse assemblage of species in which either *C. rossii* or *Bromus anomalus* is prominent.

POTR-ABLA/CARO c.t. and eventually to climax plant communities in the *A. lasiocarpa* forest series. The most probable habitat type is the *A. lasiocarpa / C. rossii* as described by Youngblood and Mauk (1985). Excessive grazing no doubt has altered undergrowth composition and contributed to the lack of species diversity. Conceivably, grazing pressures may have reduced the amount of *S. oreophilus* to where it no longer is a prominent shrub. Where this occurs, the community may have once been a *Populus tremuloides / Symphoricarpos oreophilus / Carex rossii* c.t.

Production—Overall tree basal area in this type was in the upper quarter of all aspen stands, averaging 191 ft^2/acre (43.8 m^2/ha). Two-thirds of the stands should have basal areas ranging between 144 and 237 ft^2/acre (33.1 and 54.6 m^2/ha). An average of only 3 percent of this basal area in the 11 stands sampled consisted of conifers. Production for aspen, however, was only moderate, ranking in the middle third percentile of all aspen stands. Site index at 80 years averaged 50 ft (15.2 m), with two-thirds of the stands expected to have site indices between 42 and 58 ft (12.8 and 17.7 m). Volume production of aspen at stand maturity averaged between 39 and 2.7 ft^3/acre/year (2.0 and 3.5 m^3/ha/year). Aspen reproduction was highly variable, as is usually the case, but averaged a moderate 1,224 suckers/acre (3,023/ha). Density of trees was also highly variable but averaged in the upper third of all stands at 888 stems/acre (2,194/ha).

This is one of the least productive of the aspen community types for undergrowth. Annual production of air-dry herbage averaged only 257 lb/acre (289 kg/ha), which ranked in the lowest 10 percent of all stands. Two-thirds of the stands within the type should produce between only 77 and 437 lb/acre (86 and 489 kg/ha). This meager undergrowth production is dominated by graminoids at 63 percent, with lesser quantities of forbs at 34 percent, and few shrubs, at 3 percent. Although low in overall productivity, this mix of graminoids and forbs ranks high in suitability as livestock forage. The undergrowth was classified as 70 percent desirable and 28 percent intermediate.

The POTR/CARO c.t. is at least moderately productive of wood fiber but is rather marginal as summer range for livestock and as wildlife habitat. The quality of the forage is good, but the productivity is low, especially for sheep. The lack of diversity in vegetation structure does not meet cover requirement conducive to good habitat for many species of wildlife.

Other—These communities were not previously identified as a separate type. Similar communities were not encountered on either the Bridger-Teton National Forest or on the Caribou and Targhee National Forests. In the Utah classification (Mueggler and Campbell 1986), communities of this composition and structure were combined with those in which *Carex geyeri* was the herbaceous epithet. The need for a separate type in which *Carex rossii* is a key indicator species became apparent only after sampling the aspen communities in Nevada.

Populus tremuloides—Abies lasiocarpa/ Carex rossii Community Type (POTR-ABLA/CARO c.t.)

Distribution—Although the POTR-ABLA/CARO c.t. makes up only slightly more than 2 percent of the aspen communities within the Region, it is the most frequently encountered aspen type on the high plateaus of southern Utah. It accounts for 20 percent of the aspen stands on the Dixie National Forest and 12 percent of those on the Fishlake (appendix C). It was not observed in Wyoming, Idaho, or northern Utah, and only infrequently in Nevada on the Humboldt and Toiyabe National Forests.

This high-elevation type ranges from 8,000 ft (2,400 m) to 10,300 ft (3,100 m). More than four-fifths of the stands sampled occurred at elevations in excess of 9,000 ft (2,700 m). Communities of this type grew primarily on relatively gentle slopes of all exposures and configurations. However, over 90 percent of the stands occurred on soils derived from igneous parent materials, primarily volcanics.

Vegetation—This major seral community type is characterized by the abundance of *Abies lasiocarpa* or *Picea engelmannii* in the tree layer, along with *Populus tremuloides* and a rather sparse, simple undergrowth that lacks a well-defined shrub stratum (fig. 19). There is a prominence of the graminoids *Carex rossii* or *Bromus anomalus* or both, and sometimes the low-growing forb *Trifolium* spp. Forbs are generally sparse, with the occasional exception of an abundance of *Trifolium* spp. or *Astragalus miser*. Other common forbs are *Achillea millefolium, Lupinus argenteus, Fragaria vesca,* and *Taraxacum officinale*. Minor quantities of such shrubs as *Symphoricarpos oreophilus*, *Juniperus communis*, or *Berberis repens* may be present but are seldom prominent. Annual plants are typically scarce. The undergrowth is similar to that of the POTR/CARO c.t. except for the prominence of conifers in the tree stratum.

Succession—This is an important seral community type within the *A. lasiocarpa* climax forest series. Given sufficient time the aspen will gradually be replaced by *A. lasiocarpa* and *P. engelmannii*, and undergrowth production will become even more sparse. The type probably represents a major seral community within the *A. lasiocarpa / C. rossii* habitat type of southern Utah (Youngblood and Mauk 1985). Heavy grazing will cause even greater species impoverishment. Grazing tends to favor the dominance of such grazing-resistant species as *T. officinale, A. miser, Trifolium* spp., *A. millefolium*, and perhaps *F. vesca*.

Production—Total tree basal area is fairly good, but aspen productivity is below average for aspen stands within the Region. Stand basal area averaged 190 ft^2/acre (43.7 m^2/ha), which is in the upper quartile of all stands. Two-thirds of the stands within the type can be expected to have between 133 and 247 ft^2/acre (30.5 and 56.7 m^2/ha). A total of 76 percent of this was aspen and the rest was

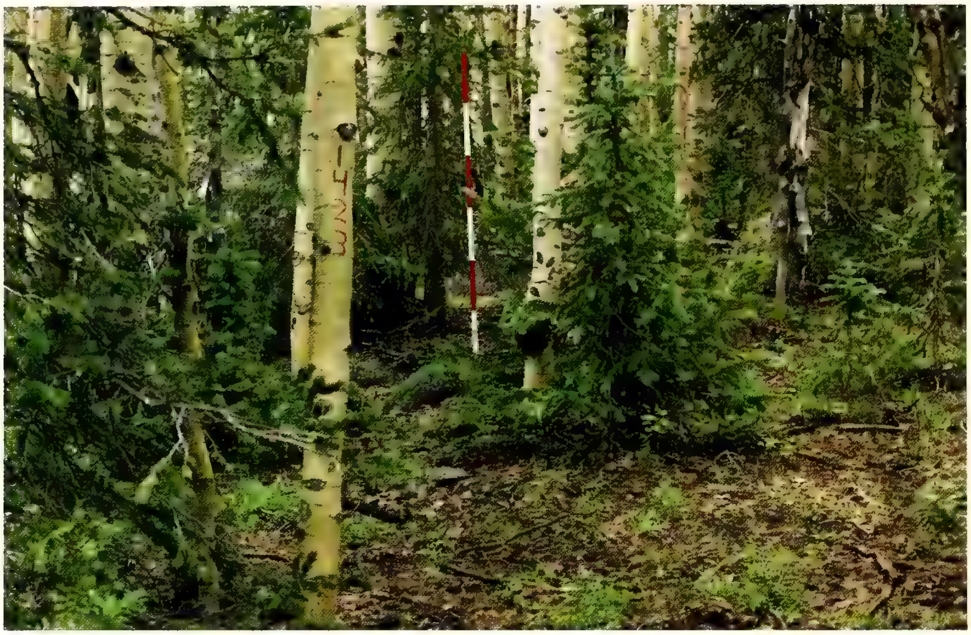

Figure 19—The *Populus tremuloides—Abies lasiocarpa/Carex rossii* c.t. is a major successional type most frequently encountered on the plateaus of southern Utah. The undergrowth is similar to that in the *P. tremuloides/C. rossii* c.t., but dominance of aspen in the tree layer is gradually changing to conifers.

conifers. Site index and volume production for aspen ranked in the lower third percentile for all aspen stands. Aspen site index at 80 years for the 16 stands sampled for production averaged 44 ft (13.3 m). Two-thirds of the stands should be between 37 and 51 ft (11.3 and 15.5 m). Aspen volume production at stand maturity averaged 31 ft^3/acre/year (2.1 m^3/ha/year), with between-stand variability such that two-thirds of the stands within the type should produce between 22 and 40 ft^3/acre/year (1.5 and 2.8 m^3/ha/year). Aspen reproduction averaged a moderate 2,156 suckers/acre (5,328/ha), with tree density averaging a moderate 737 stems/acre (1,806/ha). Established conifer seedlings averaged 1,771/acre (4,376/ha), 87 percent of which were *A. lasiocarpa*.

This type produces less undergrowth on the average than any of the other aspen community types. Annual air-dry herbage averaged only 190 lb/acre (213 kg/ha); two-thirds of the stands should produce somewhere between 25 and 355 lb/acre (28 and 398 kg/ha). In contrast to the closely associated POTR/CARO c.t., the bulk of this undergrowth is forbs, 60 percent, rather than graminoids, 36 percent. This suggests that the graminoids tend to decrease in abundance as intensity of shading increases because of increased amounts of conifers in the tree layer. Shrubs averaged only 4 percent of the undergrowth. The overall suitability of this undergrowth as livestock forage was only moderate, with 49 percent desirable and 47 percent intermediate.

Although total stand basal area is fairly high, the POTR-ABLA/CARO c.t. is somewhat below average for the production of wood fiber. It is poor summer range for livestock because of meager undergrowth productivity. Wildlife habitat values are also low because the vegetation lacks diversity in structure and species composition.

Other—As with the POTR/CARO c.t., this type was not identified separately in previous classifications. Similar communities were encountered in southern Utah, but they were included in the *Populus tremuloides—Abies lasiocarpa / Carex geyeri* c.t. (Mueggler and Campbell 1986). Most of the stands in this type are more properly identified as belonging to the POTR-ABLA/CARO c.t.

Populus tremuloides/Bromus carinatus Community Type (POTR/BRCA c.t.)

Distribution—This major community type occurs on all of the National Forests within the study area. It is abundant on the Humboldt and Toiyabe National Forests in Nevada where it accounts for 8 and 10 percent of the aspen communities, respectively. It is also common on the Wasatch-Cache National Forest in northern Utah where it accounts for 5 percent of the aspen communities. The type is particularly abundant on the Schell Creek Range in eastern Nevada and on the Bear River Range in northern Utah.

The POTR/BRCA c.t. usually appeared at moderately high elevations. The lowest elevation was 6,200 ft (1,900 m) in eastern Idaho and the highest was 10,000 ft (3,000 m) in central Utah. Three-fourths of the stands grew at elevations over 8,000 ft (2,400 m). Most were found on slopes, some very steep, but the type does not appear limited by exposure or confined to soils of any particular parent material.

Vegetation—The vegetation is structurally simple and is typified by the absence of a conspicuous conifer element in the tree layer, a lack of a well-defined shrub layer, and

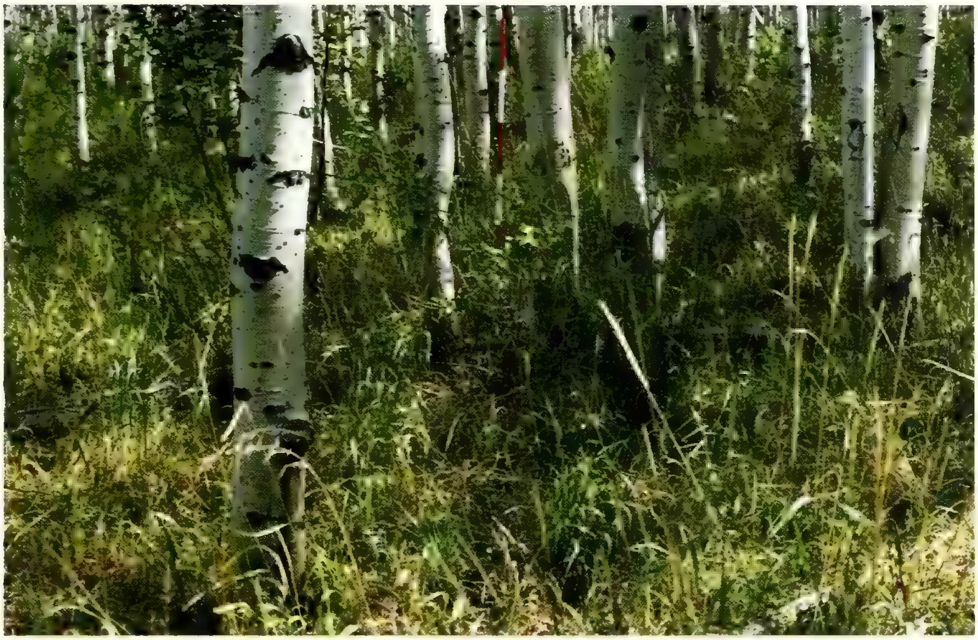

Figure 20—The *Populus tremuloides/Bromus carinatus* c.t. is a grazing-altered type that occurs throughout the Region but is particularly common in Nevada. The undergrowth is characterized by an abundance of one or more of the tall grasses, *B. carinatus, Elymus glaucus,* or *Agropyron trachycaulum*, and general scarcity of tall forbs.

an herbaceous layer dominated by one or more of the following tall grasses: *Bromus carinatus, Elymus glaucus,* or *Agropyron trachycaulum* (fig. 20). Other graminoids frequently abundant are *Melica spectabilis, Poa pratensis,* and sometimes *Carex hoodii* and *Stipa occidentalis*. The most common forbs are the low-growing *Stellaria jamesiana, Achillea millefolium, Thalictrum fendleri,* and *Taraxiacum officinale.* Occasionally, *Lathyrus* spp. or *Vicia americana* are abundant. Tall-growing forbs such as *Agastache urticifolia, Hackelia floribunda, Rudbeckia occidentalis,* and *Senecio serra* may be present but never in sufficient quantity to qualify as a POTR/TALL FORB type. Annuals such as *Polygonum douglasii, Nemophila breviflora,* and *Collomia linearis* are occasionally abundant. Some shrubs may be present but they do not form a distinct layer. In fact, over half the 77 stands sampled in this type contained small amounts of *Symphoricarpos oreophilus* and about a fifth contained small quantities of *Rosa woodsii*. Most of the time the stands have distinctly grassy undergrowth with a scattering of forbs. In some instances, where past grazing has been heavy, the undergrowth is sparse and only remnants of the identifying species remain with annuals.

Succession—Although in most cases the aspen overstory appears to be stable in the POTR/BRCA c.t., the undergrowth is considerably altered by grazing. The type is most likely seral to the POTR/TALL FORB climax community type. Heavy and prolonged sheep use has reduced the abundance of tall forbs and permitted substantial increases in the amount of *B. carinatus, E. glaucus,* and *A. trachycaulum*. The type is similar to the *Populus tremuloides / Symphoricarpos oreophilus / Bromus carinatus* c.t. except for lesser amounts of *S. oreophilus*, which tends to decrease with heavy sheep use. It is thus possible that the POTR/BRCA c.t. may also be a grazing-induced seral stage of the POTR/SYOR/TALL FORB climax community type. Heavy grazing by cattle would tend to reduce the amount of *B. carinatus, A. trachycaulum,* and *E. glaucus* and enable an increase in *R. occidentalis, P. pratensis,* and *T. officinale*. *Abies lasiocarpa* occurred in about a fourth of the stands but only in minor quantities. Conceivably, given sufficient time, these stands might eventually succeed to dominance by this conifer.

Production—Total stand basal area, of which 98 percent was aspen, averaged a moderate 149 ft^2/acre (34.1 m^2/ha). Two-thirds of the stands should have basal areas between 89 and 209 ft^2/acre (20.4 and 48.0 m^2/ha). Both site index and volume growth of aspen were in the mid-third percentile of all stands sampled. Site index at 80 years for the 32 stands sampled averaged 54 ft (16.3 m), with two-thirds of the stands expected to range between 45 and 63 ft (13.7 and 19.2 m). Average volume production at stand maturity averaged 44 ft^3/acre/year (3.1 m^3/ha/year), with two-thirds of the stands between 32 and 56 ft^3/acre/year (2.2 and 3.9 m^3/ha/year). Although highly variable, aspen reproduction was good at 2,748 suckers/acre (6,791/ha), ranking the type within the upper quarter of all aspen stands. Tree density was moderate, averaging 785 stems/acre (1,939/ha).

Annual production of undergrowth ranked in the upper third of all aspen stands, averaging 1,111 lb/acre (1,245 kg/ha) of air-dry herbage. Two-thirds of the stands should produce somewhere between 719 and 1,503 lb/acre (805 and 1,683 kg/ha). Graminoids and forbs contributed about equally to this production, with 52 and 47 percent, respectively. Shrubs were only 1 percent of the total.

This undergrowth was only moderately suitable as forage, with 41 percent categorized as desirable, 45 percent intermediate, and 14 percent least desirable.

The POTR/BRCA c.t. is thus considered moderately productive of wood fiber and above average in livestock forage production. The abundance of graminoids and lack of shrubs suggest that it is generally more suitable as summer range for cattle than it is for sheep. Wildlife habitat values are comparatively low because of the lack of diversity in both vegetation structure and species composition. Essentially, the type has only the two strata: an aspen overstory underlain by herbaceous undergrowth.

Other—This type remains the same as identified in the Utah aspen classification (Mueggler and Campbell 1986). It was not identified separately in either the Bridger-Teton National Forest classification (Youngblood and Mueggler 1981) or in the Caribou and Targhee National Forests classifications (Mueggler and Campbell 1982). However, a minor portion of the stands identified as part of the *Populus tremuloides/Poa pratensis* c.t. in the latter classification is more properly included in the current POTR/BRCA type.

This seral type has not been reported to occur elsewhere. Because it is believed to represent a grazing-degraded stage of the POTR/TALL FORB type, which appears to be present in southeastern Wyoming and in Colorado, this seral type probably occurs there as well.

Populus tremuloides/Symphoricarpos oreophilus/Bromus carinatus Community Type (POTR/SYOR/BRCA c.t.)

Distribution—This major, disturbed community type was observed on all National Forests within the study area except the Bridger-Teton and Targhee. It is fairly common in northern and central Utah and Nevada. It appears to be particularly abundant on the Schell Creek and the northern end of the Toiyabe Ranges of Nevada and on the Bear River Range and Tavaputs Plateau of northern Utah.

The POTR/SYOR/BRCA c.t. is an intermediate elevation type ranging from a low of 6,400 ft (2,000 m) on the Wasatch-Cache National Forest to a high of 9,900 ft (3,000 m) on the Humboldt. Almost 90 percent of the stands sampled, however, were between 7,000 and 9,000 ft (2,100 and 2,700 m). Most of the stands were on shallow slopes, less than 25 percent steepness, and equally common on all aspects and soil parent materials.

Vegetation—The vegetation reflects considerable alteration caused by livestock grazing. It is characterized by the exclusive dominance of aspen in the tree layer, the presence of a distinct layer of low shrubs dominated almost exclusively by *Symphoricarpos oreophilus*, the absence of a distinct tall shrub layer, and an herb layer dominated primarily by the tall-growing grasses *Bromus carinatus*, *Agropyron trachycaulum*, and *Elymus glaucus* (fig. 21). This tall grass dominance is largely by default in the absence of prominent amounts of tall forbs, characterizing low forbs, and the graminoids *Calamagrostis rubescens* and *Carex geyeri*. Low forbs are always present but seldom abundant. This is especially true with *Geranium viscosissimum*, *Thalictrum fendleri*, and *Osmorhiza chilensis*. Occasionally, *Stellaria jamesiana* and *Taraxacum officinale* are abundant. *Rosa woodsii* and *Berberis repens* are frequently present in the shrub stratum. In some instances *Stipa occidentalis* may be an abundant grass. Although annuals are often present, they are seldom abundant. Occasionally, such conifers as *Abies lasiocarpa* and *Pseudotsuga menziesii* may be present in the tree layer or as reproduction, but they too are never abundant.

Succession—This is primarily a stable aspen type but with undergrowth that is in a successional stage leading to a POTR/SYOR/TALL FORB climax community type. A paucity of the tall forbs that commonly typify the POTR/SYOR/TALL FORB type and the proportionately greater role of such tall grasses as *B. carinatus, E. glaucus,* and *A. trachycaulum* are attributed to grazing influences, probably by sheep. Heavy, continued grazing pressure could lead to more pronounced changes, such as a decrease in *S. oreophilus*, and replacement of the remaining desirable perennial herbs with yet greater amounts of *Poa pratensis*, *T. officinale*, and *S. jamesiana*. In those few instances where conifers appear to be slowly invading, the communities in this type may be successional to either *A. lasiocarpa* or *P. menziesii* coniferous forest climax series.

Production—Stand basal area for the 10 stands sampled for production ranks in the lower quarter of all types. Average basal area, almost all of which was aspen, was only 104 ft^2/acre (23.8 m^2/ha). Two-thirds of the stands should produce between 90 and 118 ft^2/acre (20.7 and 17.1 m^2/ha). However, site index and estimated volume growth of aspen is at least moderate, ranking in the mid-third percentile of all stands. Site index averaged 47 ft (14.5 m), with two-thirds of the stands expected to fall between 41 and 53 ft (12.5 and 16.2 m). Estimated volume growth at maturity averaged 36 ft^3/acre/year (2.5 m^3/ha/year), with two-thirds of the stands producing between 29 and 43 ft^3/acre/year (2.0 and 3.0 m^3/ha/year). Aspen reproduction, though highly variable from stand to stand, ranked in the upper tenth of all stands at 6,451 suckers/acre (15,904/ha). Tree density was also high, averaging 1,005 stems/acre (2,483/ha).

Undergrowth production averaged a moderate 1,008 lb/acre (1,130 kg/ha), with two-thirds of the stands expected to produce between 292 and 1,724 lb/acre (327 and 1,931 kg/ha). Forbs at 47 percent usually formed the greater part of this production followed closely by graminoids at 39 percent. Shrubs are much more productive here than in the POTR/BRCA c.t., accounting for 14 percent of the total annual production of undergrowth. This undergrowth is considered moderately suitable as livestock forage, with 42 percent classified as desirable, 46 percent as intermediate, and 12 percent as least desirable.

Thus, the POTR/SYOR/BRCA c.t. is slightly less productive of wood fiber and of forage than the related POTR/BRCA c.t. Its moderate forage-producing capabilities appear about equally suited for either sheep or cattle. This type is better for wildlife habitat than the POTR/BRCA c.t. because of the presence of a shrub stratum that improves the diversity of vegetation structure and overall hiding cover.

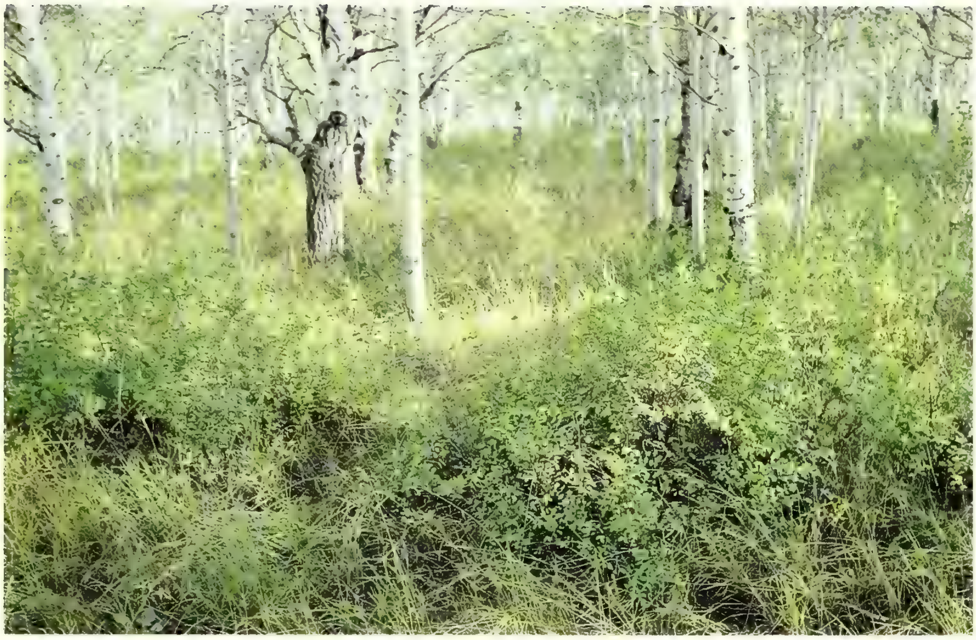

Figure 21—The *Populus tremuloides/Symphoricarpos oreophilus/Bromus carinatus* c.t. is similar to the POTR/BRCA c.t. except for the presence of a layer of low shrubs intermixed with the tall grass-herb stratum. This grazing-induced type is most common in northern and central Utah and Nevada.

Other—This seral community type is the same as that described in the Utah aspen classification (Mueggler and Campbell 1986). Communities of this description were not encountered in either Idaho or Wyoming and thus were not included in earlier classifications.

MINOR ASPEN COMMUNITY TYPES

Populus tremuloides/Wyethia amplexicaulis Community Type (POTR/WYAM c.t.)

Distribution—This minor community type is confined primarily to the northern part of the Region. It was observed only on the Bridger-Teton, Targhee, Caribou, Wasatch-Cache, and Humboldt National Forests. The type appeared most frequently in northeastern Nevada on the Jarbidge and Independence Ranges of the Humboldt; it was also observed on the East Humboldt and Santa Rosa Ranges. The type occurs along the Wyoming and Salt River Ranges of Wyoming and intermittently in Idaho from the Bear River Range north to the Centennials.

The POTR/WYAM c.t. is a low-elevation type. Three-fourths of the 30 stands sampled were below 7,000 ft (2,100 m). It usually occurs on fairly gentle terrain with slopes seldom exceeding 25 percent. The type generally occupies fairly heavy, clayey soils, particularly in Idaho and Wyoming.

Vegetation—The vegetation of the POTR/WYAM c.t. lacks structural diversity. Stands commonly consist of a rather open tree stratum of *Populus tremuloides* over an herbaceous undergrowth dominated largely by the relatively broad-leaved *Wyethia amplexicaulis* (fig. 22). Occasionally, shrubs are present, primarily *Symphoricarpos oreophilus* and sometimes *Amelanchier alnifolia*, but they are not abundant enough to form a distinct stratum. *Wyethia amplexicaulis* either completely dominates the undergrowth or is sufficiently abundant to suggest potential dominance. Other fairly common and abundant forbs are *Senecio serra*, *Hackelia floribunda*, and *Taraxacum officinale*. Grasses frequently are an important part of the herbaceous complex. Most commonly encountered of these are *Bromus carinatus*, *Agropyron trachycaulum*, and *Poa pratensis*. Occasionally, *Elymus glaucus* is abundant. Annual forbs such as *Nemophila breviflora* and *Galium bifolium* are sometimes fairly common.

Succession—The aspen overstory is not subject to replacement by conifers. The type is thus successionally stable with respect to the tree overstory. However, the undergrowth of some stands has been appreciably altered by abusive livestock grazing as evidenced by the overwhelming dominance of the unpalatable *W. amplexicaulis* in an environment that is supportive of palatable grasses and forbs. Extreme examples occur in meadows and on gentle slopes that appear to be almost exclusively occupied by dense cover of *W. amplexicaulis* under open stands of aspen.

Production—Aspen usually grows in rather open, parklike stands in this type. It is one of the least productive types for growth of any of the community types, averaging only 74 ft^2/acre (17.0 m^2/ha) of basal area. Site index for aspen at 80 years was only 30 ft (9.1 m), and estimated aspen volume production at stand maturity 13 ft^3/acre/year (0.9 m^3/ha/year). All three of these measures of tree

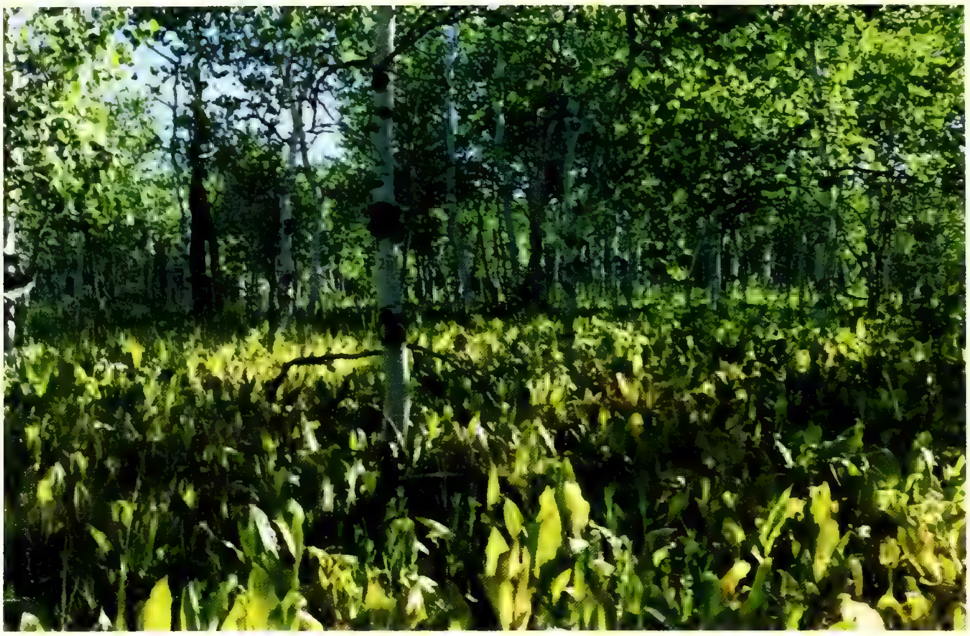

Figure 22—The *Populus tremuloides/Wyethia amplexicaulis* c.t., a distinctive type encountered occasionally in the northern part of the Intermountain Region, is characterized by a rather open stand of aspen under which the broad-leaved forb *W. amplexicaulis* dominates. The type generally occupies fairly heavy, clayey soils.

productivity fell within the lowest 10 percent of all aspen stands. Aspen reproduction was a relatively poor 252 suckers/acre (621/ha), with a moderate density of trees averaging 664 stems/acre (1,640/ha).

Total production of undergrowth was a relatively good 1,176 lb/acre (1,319 kg/ha), which is within the upper third percentile of all stands. However, this undergrowth was primarily forbs at 89 percent. The unpalatable *W. amplexicaulis* was usually the dominant forb species. Of the undergrowth, 10 percent consisted of graminoids and only 1 percent of shrubs. Suitability of the undergrowth as forage was generally in the lowest quarter of all stands sampled, with 39 percent classified as desirable, 28 percent as intermediate, and 33 percent as least desirable. The type thus is considered relatively poor livestock range despite the above-average production of undergrowth. It is also poor habitat for wildlife because of the small amount of structural diversity in the vegetation and poor species diversity.

Other—The POTR/WYAM c.t. was recognized by this name in both the Bridger-Teton National Forest classification (Youngblood and Mueggler 1981) and in the Caribou and Targhee National Forests classification (Mueggler and Campbell 1982). Because it rarely occurs in Utah, the type was not included in the Utah classification (Mueggler and Campbell 1986). Communities have not been reported in either Colorado or southeastern Wyoming. However, because it is fairly common in adjacent Idaho on the Targhee National Forest, the type can likely be encountered in southwestern Montana.

Populus tremuloides/Artemisia tridentata Community Type (POTR/ARTR c.t.)

Distribution—This minor type was observed on the Bridger-Teton National Forest in western Wyoming, on the Wasatch-Cache, Ashley, Uinta, and Fishlake National Forests in Utah, and on the Humboldt and Toiyabe National Forests in Nevada. It was most abundant on the Toiyabe where it accounted for 12 percent of the sampled stands. It was not common elsewhere. It is a mid-elevation type. All 27 stands sampled grew between 6,900 and 9,400 ft (2,100 and 2,900 m). Most were on less than 40 percent slopes and were not confined by either exposure or soil parent rock. This type occurs as an ecotone or as small single-clone islands between the sagebrush-grass steppes and the less arid aspen or conifer forests, particularly in the northern part of the Region.

Vegetation—Conifers are seldom present either in the overstory or as regeneration. The vegetation is characterized by the presence of at least 10 percent canopy cover of *Artemisia tridentata* in the shrub layer (fig. 23), even though *Symphoricarpos oreophilus* or *Juniperus communis* may be more abundant at times. Tall shrub species seldom occur, and they are never abundant. *Artemisia tridentata* may also be present in other community types but only as a minor constituent of undergrowth clearly dominated by other vegetation. The herbaceous undergrowth of the POTR/ARTR c.t. is generally species poor.

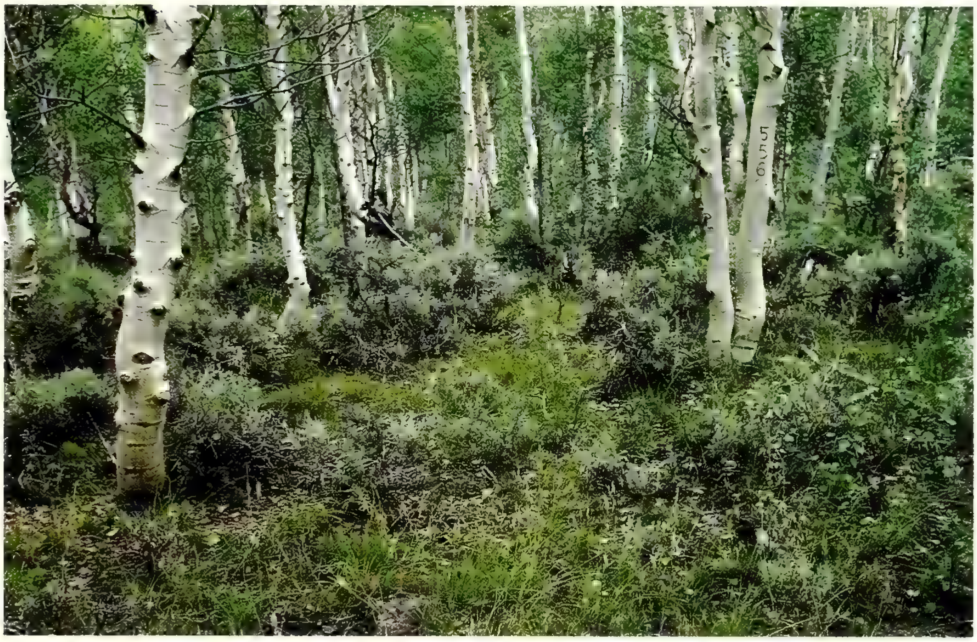

Figure 23—Although usually scarce elsewhere, the *Populus tremuloides/ Artemisia tridentata* c.t. is rather common on the Toiyabe National Forest in Nevada. It occupies relatively dry sites and is characterized by the conspicuous presence of *A. tridentata* in the shrub stratum beneath a rather sparse aspen overstory.

The most common graminoids are *Agropyron trachycaulum* and *Stipa occidentalis*. A variety of other species may be encountered but not regularly. Some, however, such as *Stipa comata, Poa fendleriana, Carex rossii, C. geyeri*, and *Bromus ciliatus*, may be fairly abundant when they are present. Forbs and annuals are usually rather sparse, and no single species is characteristic of the type. *Taraxacum officinale*, which occurred in almost two-thirds of the stands, was among the most common forbs. Other forbs that were relatively common in at least a third of the stands were *Antennaria microphylla, Lupinus argenteus, Achillea millefolium*, and *Stellaria jamesiana*.

Succession—The POTR/ARTR c.t. is believed to have a relatively stable aspen overstory most of the time. However, in some stands the aspen overstory was slowly degenerating and not being replaced by reproduction. Failure of the aspen to successfully reproduce could be attributable at least in part to constant browsing by livestock, but perhaps other factors such as disease or climatic change could be involved. In any event, the aspen community is gradually being replaced by sagebrush steppe. Heavy livestock grazing is rather typical in this type, likely resulting in considerable alteration of the undergrowth, reflected particularly in the paucity of palatable forbs.

Production—The POTR/ARTR c.t. is the least productive aspen type in the Region for tree growth. Total tree basal areas in the two stands sampled for productivity averaged only 56 ft^2/acre (12.8 m^2/ha). Only 8 percent of this consisted of conifers. Site index for aspen averaged 29 ft (8.9 m), and estimated aspen volume growth at maturity averaged 12 ft^3/acre/year (0.8 m^3/ha/year). Despite low tree productivity, both the number of trees and aspen reproduction were in at least the mid-range for all aspen stands. An average of 1,865 suckers were observed per acre (4,607/ha) and 546 trees/acre (1,349/ha).

Annual production of undergrowth averaged in the middle third percentile of all aspen stands, producing 715 lb/acre (802 kg/ha) of air-dry material. This undergrowth usually consisted of a good balance of different vegetation classes. Graminoids averaged 42 percent, shrubs 30 percent, and forbs 8 percent. The suitability of this undergrowth as forage for livestock was among the highest of any of the aspen types, with 76 percent classified as desirable and 19 percent as intermediate. Thus, although the type may be poor from the standpoint of producing wood fiber, it ranks above average as summer range for livestock. It is of moderate value as wildlife habitat.

Other—The POTR/ARTR c.t. was recognized by this name in the Bridger-Teton National Forest classification (Youngblood and Mueggler 1981). Communities with this structure and composition were identified in the Caribou and Targhee National Forests classification (Mueggler and Campbell 1982) as the *P. tremuloides / A. tridentata—Festuca idahoensis* c.t. The few communities similar in composition and structure that were encountered in Utah were initially placed in a broader *P. tremuloides / J. communis / Sitanion hysterix* c.t. (Mueggler and Campbell 1986). Communities in which *A. tridentata* is a prominent shrub under an aspen canopy have not yet been reported outside of the Intermountain Region.

The type includes a variant dominated by what appears to be pigmy aspen. This variant occurs as small, isolated single-clone groves surrounded by sagebrush steppe. It was observed primarily in eastern Idaho on the southern fringe of the Yellowstone Plateau and along the southern, low-elevation margin of the Centennial Mountains on the Targhee National Forest. The rather dense aspen overstory may be over 25 years old, but the basal diameters of the stems are only 2 to 3 inches (5 to 8 cm) and their heights seldom exceed 10 ft (3 m). Judging from the presence of old dead stems and the lack of evidence of fire, these groves apparently continue to reproduce naturally and persist for long periods. The environment is generally harsh. Some of these pigmy stands have crooked boles, which may be caused by drifting snow. Whether the dwarf nature of the aspen in these clones is genetically or environmentally induced has not been determined.

Populus tremuloides/Juniperus communis/Carex geyeri Community Type (POTR/JUCO/CAGE c.t.)

Distribution—The POTR/JUCO/CAGE c.t. is a minor community type that is restricted primarily to the southeastern slope of the Uinta Mountains in northeastern Utah. It is, however, the most frequently encountered type on the Ashley National Forest where it comprised 18 percent of the aspen communities. Examples were also seen on the Wasatch-Cache, Caribou, and Fishlake National Forests but not elsewhere in the Region.

The type occurs at moderately high elevations, considering the latitude of northern Utah; 95 percent of the stands sampled were between 8,000 and 9,000 ft (2,400 and 2,700 m). Most of these stands were on fairly gentle slopes (less than 15 percent steepness) and on all exposures. Although they grew on a variety of soils, almost two-thirds of the soils were derived from sandstone parent rock.

Vegetation—The vegetation in the POTR/JUCO/CAGE c.t. is usually clearly defined. Community structure is relatively simple, with the *Populus tremuloides* overstory underlain by a component of low shrub distinguished by the prominence of *Juniperus communis* (fig. 24). Other low shrubs, especially *Symphoricarpos oreophilus* and *Berberis repens*, may also be present and even more abundant than *J. communis*, but the obvious physiognomy of the latter serves as a type indicator. *Juniperus communis* generally grows as separate, low, compact clumps widely scattered beneath the aspen canopy. These clumps frequently are interspersed with *S. oreophilus* or *B. repens*, which may form a substantial part of the shrub layer. The herbaceous stratum contains a high complement of graminoids of which *Carex geyeri* is the usual dominant. Occasionally, *Calamagrostis rubescens* may replace *C. geyeri* in this role. Other common grasses are *Stipa occidentalis*, which occurred in over three-fourths of the 23 stands sampled, and *Agropyron trachycaulum*. Low-growing forbs, particularly *Geranium viscosissimum*, *Astragalus miser*, *Lupinus argenteus*, and *Taraxacum officinale*, can be fairly abundant in some stands. Other forbs with moderate to high constancy include *Potentilla gracilis*, *Achillea millefolium*, *Antennaria microphylla*, and *Stellaria jamesiana*. Annual plants are scarce. Conifers, particularly *Pinus contorta* or *Pseudotsuga menziesii*, may be present but are never a prominent part of the tree layer.

Succession—Stands are ordinarily in a stable aspen overstory condition. In those few cases where conifers appear able to invade, judging from the presence of conifer reproduction, the stands may be a successional stage within the *Abies lasiocarpa* or *P. menziesii* forest climax

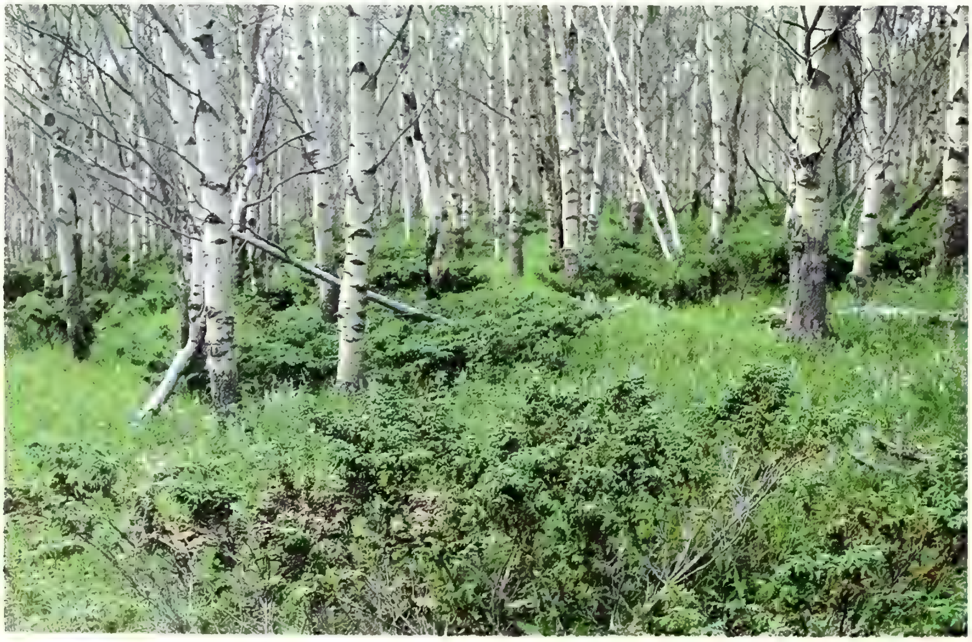

Figure 24—The *Populus tremuloides/Juniperus communis/Carex geyeri* c.t. is common on the south slope of the Uinta Mountains on the Ashley National Forest in northeastern Utah. A low shrub layer in which *J. communis* is a distinctive component, combined with primarily graminoid herb layer usually dominated by *C. geyeri*, characterize the type.

series. Where seral, the type will most likely proceed to either the *Populus tremuloides-Abies lasiocarpa/Juniperus communis* or *P. tremuloides-P. menziesii/J. communis* c.t.'s, which are believed to represent seral stages within the northern Utah *A. lasiocarpa / J. communis* and *P. menziesii/S. oreophilus* habitat types, respectively (Mauk and Henderson 1984). Excessive livestock grazing will likely lead to substantial increases in the amount of *T. officinale*, *A. miser*, *A. millefolium*, and possibly *J. communis* at the expense of the more palatable and less tenacious forage species.

Production—Production of trees in the POTR/JUCO/CAGE c.t. is about average for aspen communities in the Region. In the three stands sampled for production, basal area averaged 162 ft^2/acre (37.2 m^2/ha), site index for aspen at 80 years averaged 48 ft (14.5 m), and estimated volume production of aspen at stand maturity averaged 36 ft^3/acre/year (2.5 m^3/ha/year). Reproduction of aspen at 1,576 suckers/acre (3,896/ha) averaged in the upper third percentile of all stands. Tree density, however, was close to average for all stands at 842/acre (2,080/ha). The type therefore is moderately productive of wood fiber.

The annual production of undergrowth was in the lower third percentile of all stands. Air-dry production ranged from 415 to 833 lb/acre (465 to 934 kg/ha) and averaged 667 lb/acre (747 kg/ha). This undergrowth was composed primarily of a mixture of graminoids, 45 percent, and forbs, 50 percent. Only 5 percent of the annual herbage growth consisted of shrubs, mostly the unpalatable *J. communis*. Overall suitability of this undergrowth as livestock forage appears to be about average for all aspen stands, with 49 percent classified as desirable and 38 percent as intermediate. The balanced mixture of graminoids and forbs suggests that the type would be about equally suited for cattle and sheep. Wildlife habitat values are limited by the openness of the undergrowth and lack of good hiding cover.

Other—Our POTR/JUCO/CAGE c.t. is less inclusive than the community type by the same name described in the Utah classification (Mueggler and Campbell 1986). Somewhat similar communities with a low shrub layer dominated by *J. communis* and *C. geyeri* as the characterizing herbaceous species have been reported from southeastern Wyoming (Alexander and others 1986). These were included as part of a more general *P. tremuloides / C. geyeri* habitat type.

Populus tremuloides/Poa pratensis Community Type (POTR/POPR c.t.)

Distribution—The POTR/POPR c.t. is a grazing-induced type that, although not common, is fairly widespread across the Region. It occurs in Utah from the Bear River and Uinta Mountains in the north to the Markagunt Plateau and Abajo Mountains to the south, and in Nevada from the Jarbidge Mountains in the north to the Schell Creek Range in the south. It is an intermediate elevation type, with almost three-fourths of the 20 stands sampled at elevations between 7,000 and 9,000 ft (2,100 and 2,700 m). Most of these stands were on flat to gently sloping benches, lower slopes, or along stream bottoms. Soil parent material does not appear restrictive.

Vegetation—The vegetation of this altered type is simple in both structure and species composition. Although shrubs may be present in minor quantities, they are never abundant enough to form distinct strata, and intense past grazing has caused a reduction in diversity of the herbaceous undergrowth. The tree overstory may contain occasional conifers, especially *Abies lasiocarpa* or *Picea engelmannii*. Shrubs such as *Symphoricarpos oreophilus*, *Juniperus communis*, *Rosa woodsii*, and *Berberis repens* may be present occasionally in the undergrowth. However, neither the conifers nor shrubs are a prominent part of the vegetation complex. The undergrowth is primarily low-growing forbs and grasses, of which *Poa pratensis* usually dominates (fig. 25). Other grasses most often present are *Agropyron trachycaulum* and *Bromus carinatus*. The most common and usually most abundant forbs are *Taraxacum officinale* and *Achillea millefolium*. A wide variety of other forbs have been encountered in this type, such as *Thalictrum fendleri*, *Osmorhiza chilensis*, *Geranium viscosissimum*, and *Astragalus miser*, but they have low constancy and are seldom abundant when they do occur. Occasionally, a species such as *Trifolium longipes* will be abundant. Annuals do not appear to be an important part of the undergrowth.

Succession—A variety of conifers that now occur as incidentals may eventually come to dominate the tree layer. Stands with this potential for conifer dominance should be considered successional to a coniferous forest climax series, probably the *A. lasiocarpa*. Other stands show no evidence of invasion by conifers and appear to have relatively stable aspen overstories. However, the undergrowth of all stands reflects a long history of overgrazing of community types in which palatable shrubs and herbs once dominated. Judging from current composition, the POTR/POPR c.t. may be a grazing-induced stage of any one of the following climax or near-climax community types: POTR/SYOR/THFE, POTR/SYOR/CARU, POTR/THFE, or the POTR/CARU. Although the dominant *P. pratensis* and *T. officinale* are palatable to both cattle and sheep, their growth-form enables them to withstand grazing and increase in abundance as competition from the more grazing-susceptible species is reduced (fig. 26). Continued heavy grazing probably will not further alter the undergrowth appreciably, at least not until the aspen begins to break up with old age and heavy browsing repeatedly suppresses aspen regeneration. If this should happen, the aspen stand will eventually be lost.

Production—The POTR/POPR c.t. appears fairly productive of trees. Eight stands were sampled for production. Total tree basal area, 98 percent of which was aspen, averaged 190 ft^2/acre (43.7 m^2/ha), which was in the upper quarter of all aspen stands. Site index for aspen as well as estimated volume growth at stand maturity, however, were only slightly better than average. Site index at 80 years averaged 54 ft (16.4 m), and volume growth averaged 44 ft^3/acre/year (3.1 m^3/ha/year). All of these factors were highly variable from stand to stand. Tree density

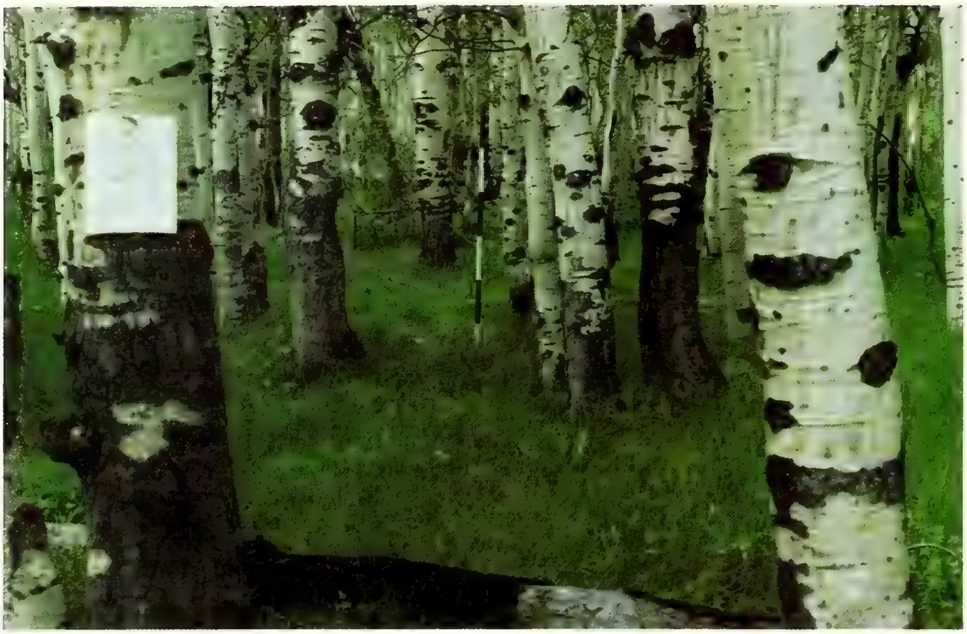

Figure 25—The *Populus tremuloides/Poa pratensis* c.t. is a fairly widespread minor type containing undergrowth principally comprising low-growing forbs and grasses usually dominated by *P. pratensis*. It is a grazing-induced type that reflects a long history of overgrazing of types such as those in figures 12, 13, 15, and 16.

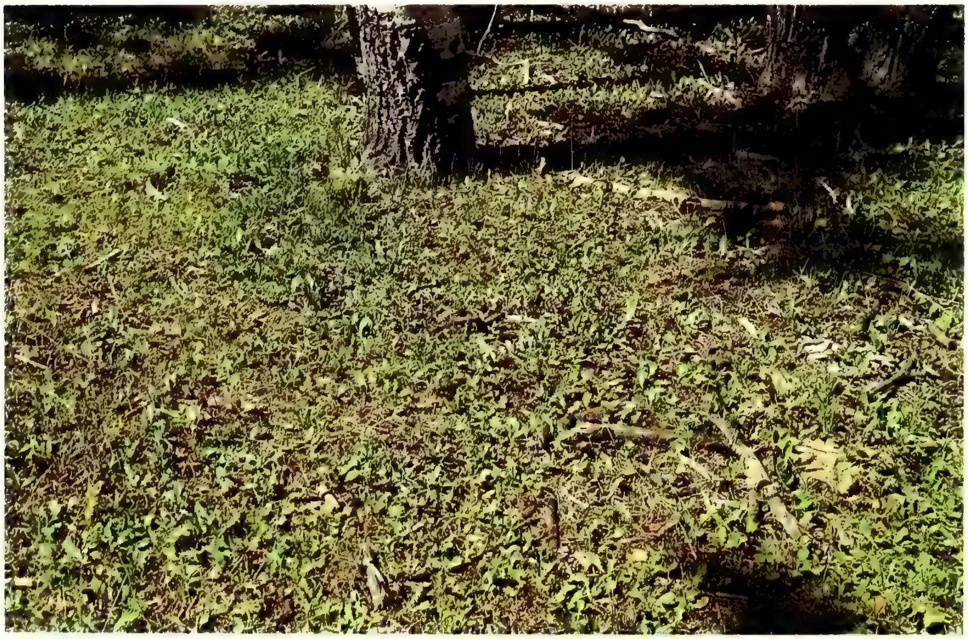

Figure 26—Prolonged abusive grazing of the *Populus tremuloides/Poa pratensis* c.t. can lead to impoverished undergrowth in which the forb *Taraxacum officinale* predominates.

averaged 888 stems/acre (2,194/ha), which was in the upper third percentile of all stands. Aspen reproduction was moderated at 616 suckers/acre (1,521/ha).

Undergrowth production consisted primarily of graminoids at 53 percent and forbs at 38 percent. Only 9 percent of the current year's growth was shrubs. Total production of undergrowth averaged a moderate 689 lb/acre (772 kg/ha) but varied from 303 to 1,289 lb/acre (340 to 1,445 kg/ha). Overall suitability of the undergrowth as forage for livestock was moderate, with only 23 percent of the cover classified as desirable and 75 percent as intermediate. The generally high proportion of graminoids and lack of shrubs suggest that the type would be better summer range for cattle than it would be for sheep. Value of the type as wildlife habitat appears fairly low because of a lack of diversity in both vegetation structure and species composition caused by an intense history of past grazing.

Other—The POTR/POPR c.t. was identified previously by this name in the Utah aspen classification (Mueggler and Campbell 1986). The Caribou and Targhee National Forests classification (Mueggler and Campbell 1982) uses this community type name, but the type contains more variation in community composition. Although not specifically reported, similar communities probably can be found in Colorado and southeastern Wyoming. The type is probably a grazing-induced seral stage of the POTR/CARU c.t., which apparently does occur in these States (Alexander and others 1986; Hoffman and Alexander 1983).

Populus tremuloides/Symphoricarpos oreophilus /Poa pratensis Community Type (POTR/SYOR/POPR c.t.)

Distribution—This minor, grazing-altered type is widespread across Utah from the Bear River Mountains in the north to the Pine Valley Mountains in the southwest. The type is common on the Manti-LaSal National Forest where it accounted for 8 percent of the communities sampled, and on the Dixie National Forest where it accounted for 7 percent of the stands. It is most abundant in the Abajo Mountains and on the Aquarius Plateau. It was seen only occasionally elsewhere in Utah. The type was not observed in Idaho or Wyoming, and only in the Schell Creek Range of eastern Nevada. This is an intermediate elevation type with over 80 percent of the 36 stands sampled at elevations between 7,000 and 9,000 ft (2,100 and 2,700 m). Most of these stands occupied gentle (less than 10 percent) slopes. Although they were observed growing on a wide variety of soils, the majority were on either sandstone parent material (47 percent) or on volcanics (29 percent).

Vegetation—The vegetation of this community type appears considerably degraded by grazing. It is similar to that of the POTR/POPR c.t. except that it has a shrub stratum. The overstory is dominated by *Populus tremuloides.*. Although conifers may be present in some stands, they are never prominent. The low shrub layer is dominated by *Symphoricarpos oreophilus*, sometimes with substantial quantities of *Rosa woodsii*. The tall shrubs *Amelanchier alnifolia* or *Prunus virginiana* are occasionally present but are never abundant enough to form a distinct stratum. The herbaceous undergrowth is usually dominated by the graminoid *Poa pratensis*. The low-growing forbs *Taraxacum officinale* and *Achillea millefolium* are common. Other common forbs are *Agastache urticifolia, Hackelia floribunda, Geranium viscosissimum*, and *Lupinus argenteus*, but these are never abundant. *Vicia americana* or *Lathyrus* spp. may sometimes be abundant.

Succession—The aspen overstory of most stands within this type is stable, with little evidence of replacement by conifers. Occasionally, however, minor amounts of conifers are present and, conceivably, could gradually replace *P. tremuloides* as the overstory dominant tree. If so, then some stands within the POTR/SYOR/POPR c.t. should be considered seral stages within a wide range of coniferous forest series, from *Abies lasiocarpa* to *Pinus ponderosa*. The undergrowth of all stands within the type reflects a long history of heavy grazing. The presence of some species, which in greater quantities serve as indicators of other community types, suggests that this type is a grazing-degraded stage of several climax community types, particularly the POTR/SYOR/TALL FORB and the POTR/SYOR/THFE. The growth characteristics of *P. pratensis* and *T. officinale*, the dominant herbs, enable them to withstand intensive grazing remarkably well. These two palatable species are able to increase under abusive grazing because of reduced competition from the more grazing-sensitive species that are equally or even less palatable to livestock. Continued abusive grazing will probably cause depletion of the shrub stratum, particularly *S. oreophilus*, and conversion to a POTR/POPR c.t.

Production—The POTR/SYOR/POPR c.t. is considerably less productive of trees and more productive of undergrowth than the closely associated POTR/POPR c.t. A total of 11 stands were sampled for production. Total tree basal area averaged 106 ft^2/acre (24.4 m^2/ha), which was in the lower quarter of all stands. Aspen site index and volume production, however, were in the mid-third percentile range, with site index averaging 50 ft (15.3 m) and volume at stand maturity averaging 40 ft^3/acre/year (2.8 m^3/ha/year). Both aspen reproduction and tree density ranked in the mid-third percentile of all stands. Reproduction averaged 1,285 suckers/acre (3,176/ha), and trees averaged 722 stems/acre (1,784/ha).

Annual production of undergrowth averaged 1,533 lb/acre (1,719 kg/ha), which was in the upper quarter of all aspen stands in the Region. However, this varied greatly from stand to stand, ranging from a low of 654 to a high of 2,537 lb/acre (733 to 2,844 kg/ha). This production was generally well distributed among the different vegetation classes, with an average 40 percent graminoids, 38 percent forbs, and 22 percent shrubs. As with the POTR/POPR c.t., suitability as livestock forage was only moderate. Only 28 percent fell into the desirable category and 63 percent into intermediate. The type is moderate to good summer range for livestock because of the high overall productivity of the undergrowth. The value of the type as wildlife habitat is moderately good because of the prominence of a shrub stratum.

Other—This community type is the same as that identified under this name in the Utah classification (Mueggler and Campbell 1986) and much the same as that identified under the same name in the Caribou and Targhee National Forests classification (Mueggler and Campbell 1982).

Populus tremuloides/Amelanchier alnifolia/Thalictrum fendleri Community Type (POTR/AMAL/THFE c.t.)

Distribution—This minor community type is widely dispersed across the northern half of the Region from the Yellowstone Plateau in Idaho southward through the Wasatch Range and Uinta Mountains in northern Utah. It is also present in the Ruby, East Humboldt, Jarbidge, and Independence mountain ranges of northeastern Nevada. The POTR/AMAL/THFE c.t. is a fairly low elevation type, with over two-thirds of the stands growing below 7,000 ft (2,100 m). Most stands grew on moderately steep, concave to undulating slopes and on both igneous and sedimentary soil parent materials.

Vegetation—The vegetation is characterized by exclusive dominance of *Populus tremuloides* in the overstory, prominence of tall shrubs in the undergrowth, lack of a distinct stratum of low shrubs, and an herbaceous layer dominated by low-growing forbs. *Amelanchier alnifolia* and *Prunus virginiana* are usually the most common tall shrubs, but *Acer grandidentatum* is abundant in some stands. Although low shrubs such as *Symphoricarpos oreophilus* and *Rosa woodsii* are frequently present, they are not prominent. *Berberis repens* is commonly encountered. The herbaceous layer is usually a mixture of a wide variety of grasses and forbs. Consequently, species diversity can be fairly great. The most often encountered and abundant forbs are *Thalictrum fendleri*, *Osmorhiza chilensis*, *Smilacina stellata*, and *Geranium viscosissimum*. The most common and abundant grasses are *Elymus glaucus* and *Poa pratensis*. A variety of annual plants, particularly *Nemophila breviflora* and *Galium aparine*, may be present but are seldom abundant.

Succession—The POTR/AMAL/THFE c.t. is a stable aspen type with little evidence of possible replacement of the tree overstory with conifers. The type in general, and certain communities in particular, show the effects of grazing impacts by the abundance of such species as *P. pratensis* and *E. glaucus* that tend to increase under grazing, especially by sheep. Judging from the occasional presence of modest amounts of certain tall forbs, some of the communities in this type may be grazing-degraded stages of a *P. tremuloides / A. alnifolia*/Tall Forb climax community type.

Production—Four stands were sampled for production. Total tree basal area averaged 129 ft²/acre (29.6 m²/ha), 98 percent of which was aspen. Site index at 80 years for aspen averaged 45 ft (13.8 m), and volume production of aspen wood at stand maturity averaged 33 ft³/acre/year (2.3 m³/ha/year). All of these tree productivity measures ranked in the mid-third percentile of all aspen stands. Aspen reproduction was high, ranking in the upper quarter of all stands at an average 5,203 suckers/acre (12,858/ha). Tree density was also in the upper quarter of all stands with an average of 1,382 stems/acre (3,414/ha). The potential of this type for the production of wood fiber appears to be about average for all aspen types in the Region.

Annual production of undergrowth is also moderate, averaging 990 lb/acre (1,109 kg/ha), which is in the mid-third percentile range for all stands. Shrubs are a major part of this at an average 39 percent. The remainder consists of a mixture of forbs at 38 percent and graminoids at 23 percent. The undergrowth is about average in suitability as forage for livestock with 40 percent classified as desirable and 56 percent as intermediate. As summer range for livestock, then, the type is in the mid-range of both productivity and suitability. It is probably much better range for sheep than it is for cattle because of the abundance of both shrubs and forbs. Considerable diversity in the structure of the undergrowth suggests that the type is better than average habitat for wildlife.

Other—This type name was not used in previous classifications. Communities with this composition were included as portions of other more general types. A major part of the *P. tremuloides / A. alnifolia—Calamagrostis rubescens* type described in the Caribou and Targhee National Forests classification (Mueggler and Campbell 1982) now belongs to this type. A minor portion of the *P. tremuloides / P. virginiana / Carex geyeri* type of the Utah classification (Mueggler and Campbell 1986), and a minor part of the *P. tremuloides / P. virginiana* type of the Bridger-Teton National Forest classification (Youngblood and Mueggler 1981), now belong to this type. The type has not been reported to occur outside of the Intermountain Region.

Populus tremuloides/Amelanchier alnifolia/Tall Forb Community Type (POTR/AMAL/TALL FORB c.t.)

Distribution—This minor type is similar to the POTR/AMAL/THFE c.t. in being widely distributed throughout the northern half of the Region, but it is somewhat more abundant. The type occurs on the Yellowstone Plateau in Idaho southward through the Wasatch Range in northern Utah. It occurs most frequently on the Humboldt National Forest, especially in the Independence and Jarbidge Mountains of northeastern Nevada. On the Humboldt, 7 percent of the aspen communities were of this type.

The POTR/AMAL/TALL FORB c.t. is a low to moderate elevation type with 90 percent of the stands below 8,000 ft (2,400 m) and two-thirds of the stands below 7,000 ft (2,100 m). The majority of the stands grew on moderately steep, northerly facing slopes, usually at the mid-slope or low-slope positions. The type does not appear to be restricted by soil parent material.

Vegetation—The vegetation has a pronounced multilayered structure. Beneath the virtually pure *Populus tremuloides* tree canopy is a layer of tall shrub species. Below the shrub layer is a mixture of tall forbs, low forbs, and graminoids. In some cases, the shrubby undergrowth is so dense that penetration is difficult. The prominence of *Prunus virginiana*, *Amelanchier alnifolia*, and in some cases *Acer grandidentatum*, identifies this as part of the tall shrub undergrowth type. Although low shrubs such as *Symphoricarpos oreophilus* are frequently present, they are never sufficiently abundant to form a separate stratum. The herbaceous layer is characterized by the prominence of one or more members of the tall forb group of species. The most common of these are *Agastache urticifolia*, *Senecio serra*, and *Hackelia floribunda*. Other members of this group that are frequently present, and at times abundant, include *Osmorhiza occidentalis*, *Valeriana occidentalis*, and *Aquilegia formosa*. Low-growing forbs are always present and frequently abundant. Most common of these are *Thalictrum fendleri*, *Osmorhiza chilensis*, *Stellaria jamesiana*, and *Smilacina racemosa*. Graminoids are most often represented by *Bromus carinatus* and *Elymus glaucus*. Annual forbs are commonly abundant, particularly *Nemophila breviflora* and *Galium aparine*. In many respects this type is similar to the POTR/AMAL-SYOR/TALL FORB c.t. except for the absence of a prominent low shrub layer.

Succession—The aspen overstory is probably stable. The tall forb undergrowth, although undoubtedly altered somewhat by livestock grazing, probably represents a climax aspen community type. Past grazing has undoubtedly resulted in some change in the herbaceous undergrowth, such as a reduction in the proportion of palatable and grazing-sensitive tall forbs and grasses, along with a corresponding increase in the less palatable or more grazing-resistant species such as *Poa pratensis*, *S. jamesiana*, *T. fendleri*, and other low-growing herbs.

Production—Tree productivity ranked in the mid-third percentile of all stands. The productivity factors varied greatly among the nine stands sampled. For example, total tree basal area averaged 124 ft^2/acre (28.4 m^2/ha) but ranged from 55 to 93 ft^2/acre (12.6 to 44.3 m^2/ha). Aspen site index at 80 years averaged 47 ft (14.5 m), and volume production at stand maturity averaged 36 ft^3/acre/year (2.5 m^3/ha/year). Aspen reproduction in the type averaged a high 5,310 suckers/acre (13,121/ha), but tree density was in the mid-third percentile for all stands at 573 stems/acre (1,416/ha). Although the variability between stands is great, the overall potential of the type for the production of wood fiber is about average for all aspen stands..

Annual production of undergrowth was also highly variable between stands. It averaged in the upper third of all stands at 1,103 lb/acre (1,237 kg/ha). Total production ranged between 529 and 1,861 lb/acre (593 and 2,087 kg/ha). The bulk of this production was forbs at 57 percent and shrubs at 30 percent. Only 13 percent was graminoids. Suitability of this undergrowth as livestock forage is somewhat below average, with only 48 percent in the desirable category, 33 percent intermediate, and a substantial 19 percent in the least desirable class. Therefore, even though forage productivity is above average, lower than average suitability of the undergrowth as forage indicates that the type is no better than average summer range for livestock. It is probably more suitable for sheep than for cattle because of the relatively large amounts of shrubs and forbs. The value of the type as wildlife habitat appears fairly high because of the relative abundance of shrubs and overall diversity of vegetation.

Other—Both the *P. tremuloides*/*P. virginiana*/*S. serra* c.t. of the Utah classification (Mueggler and Campbell 1986), and the *P. tremuloides*/*A. alnifolia—Calamagrostis rubescens* c.t. of the Caribou and Targhee National Forests classification (Mueggler and Campbell 1982) are more inclusive than the POTR/AMAL/TALL FORB c.t. Consequently, only a minor part of the stands in both of these classifications are included in this type. Most of the other stands in the earlier classifications contain considerable amounts of *S. oreophilus* and are thus in the new POTR/AMAL-SYOR/TALL FORB c.t.

Populus tremuloides/Amelanchier alnifolia—Symphoricarpos oreophilus/Bromus carinatus Community Type (POTR/AMAL-SYOR/BRCA c.t.)

Distribution—This minor type occurs primarily in Utah, but an occasional stand was observed farther north on the Caribou and Bridger-Teton National Forests in Idaho and Wyoming. The type is most abundant on the Bear River and Wasatch Ranges of northern Utah and occurs in the Uinta Mountains and as far south as the Wasatch Plateau. The type was not seen in Nevada.

This low to medium elevation type was not encountered above 7,800 ft (2,400 m). It occupies shallow to moderately steep slopes of all exposures and appears to be favored by soils derived from sedimentary parent materials, particularly sandstone.

Vegetation—Few conifers were encountered in the 21 stands sampled. The tree overstory is almost exclusively *Populus tremuloides*. The herbaceous undergrowth of this structurally complex community type has been altered considerably by grazing. The undergrowth is essentially three strata: tall shrubs, low shrubs, and herbs. *Amelanchier alnifolia* and *Prunus virginiana* are the most common and abundant tall shrub species. However, in about of the stands examined *Acer grandidentatum* was prominent. This tall shrub stratum is often broken and somewhat ill defined, but various members of the tall shrub group are, in total, a prominent part of the undergrowth. *Symphoricarpos oreophilus* usually dominates the low shrub layer. *Rosa woodsii* and *Berberis repens* are also frequently present but not nearly as abundant as *S. oreophilus*. In the northern portion of the Region, *Pachystima myrsinites* frequently is an important constituent of the low shrub stratum. The herbaceous portion of the undergrowth is a highly variable group of species. Those dominating are generally the tall grasses *Elymus glaucus*, *Bromus carinatus*, and *Agropyron trachycaulum*. *Poa* *pratensis* was abundant in about half the stands. A wide variety of forbs can be encountered, but the tall and low forbs that serve as indicators of other community types are never abundant. The most commonly encountered forbs are *Thalictrum fendleri*, *Geranium viscosissimum*, *Osmorhiza chilensis*, and *Lupinus argenteus*. Small quantities of such tall forbs as *Agastache urticifolia*, *Aster engelmannii*, and *Senecio serra* are not unusual. Occasionally, an abundance of *Lathyrus* spp. or *Vicia americana* grow matlike over the low shrubs and herbs. Annuals usually are not abundant.

Succession—The majority of stands examined in the POTR/AMAL-SYOR/BRCA c.t. appear to be stable with respect to the tree component. They will likely remain aspen-dominated communities. The undergrowth, however, appears to have undergone considerable change because of grazing. The relative abundance of graminoids, particularly *P. pratensis*, and a paucity of more palatable forbs suggest that heavy use by sheep may be responsible. Tall forbs are fairly common though not abundant suggesting that the type might be a grazing-induced seral stage of a POTR/AMAL-SYOR/TALL FORB climax community type. Prolonged abusive grazing would result in a further reduction of the palatable forbs and shrubs and eventually convert stands within this type to either a POTR/SYOR/BRCA, POTR/BRCA, or perhaps even a POTR/POPR c.t.

Production—The POTR/AMAL-SYOR/BRCA c.t. rates in the lower 25 percent of all stands for tree production as measured by total tree basal area but is within the mid-third percentile for the measures of aspen site index and annual volume increment at stand maturity. Nine stands sampled for productivity had tree basal area of only 103 ft^2/acre (23.7 m^2/ha), aspen site index of 49 ft (14.8 m), and wood volume production of 37 ft^3/acre/year (2.6 m^3/ha/year). Although aspen reproduction averaged a high 2,786 suckers/acre (6,886/ha), tree density was moderate at 709 stems/acre (1,752/ha). These measures suggest, then, that the overall potential of the type for the production of wood fiber is about average for aspen types within the Region.

Annual production of undergrowth, on the other hand, ranked in the upper third percentile of all stands, averaging 1,120 lb/acre (1,255 kg/ha). Variability between stands was high, ranging from 510 to 1,554 lb/acre (572 to 1,742 kg/ha). Most of this production consisted of vegetation of moderate forage suitability. An average 62 percent was forbs, 26 percent graminoids, and the remaining 12 percent shrubs. The undergrowth is thus above average in value as summer range for livestock. The abundance of forbs suggests that it would be better range for sheep than for cattle. Wildlife habitat values are relatively good because of the diverse vegetation structure contributed by the tall and low shrub cover.

Other—Stands with this composition were not recognized as a separate category in earlier classifications.

Populus tremuloides—Abies lasiocarpa/Symphoricarpos oreophilus/Tall Forb Community Type (POTR-ABLA/SYOR/TALL FORB c.t.)

Distribution—This minor type occurs primarily in northern Utah. Occasionally, stands were observed farther north on the Bridger-Teton and Caribou National Forests as well as farther south on the Fishlake and Manti-LaSal National Forests. The greatest concentration is along the Wasatch and Bear River Ranges in northern Utah. The type was not seen in Nevada. The POTR-ABLA/SYOR/TALL FORB c.t. is a moderately high elevation type with 90 percent of the sampled stands between 7,000 and 9,000 ft (2,100 and 2,700 m). The type occupied moderately steep slopes of all exposures, but most were on a concave or undulating slope surface. Most of the stands grew on soils derived from sedimentary parent materials.

Vegetation—This type is characterized by the presence and projected increasing abundance of *Abies lasiocarpa* in the tree layer, the absence of a prominent tall shrub stratum, the presence of a low shrub stratum, and herbaceous undergrowth in which members of the tall forb group are prominent. Communities generally have a high level of species diversity. Undergrowth composition is fairly similar to that of the POTR/SYOR/TALL FORB c.t. The low shrub stratum is usually dominated by *Symphoricarpos oreophilus*. *Rosa woodsii* is frequently present, and *Pachystima myrsinites* can often be abundant. The herb layer usually is a rich composite of forbs and graminoids. The most commonly encountered tall forbs are *Aster engelmannii, Valeriana occidentalis, Senecio serra, Agastache urticifolia, Mertensia arizonica,* and *Hackelia floribunda*. In about half the 20 stands examined, *Rudbeckia occidentalis* was abundant. The tall forbs were always accompanied by a mixture of low-growing forbs, most often *Thalictrum fendleri*, *Osmorhiza chilensis*, *Geranium viscosissimum*, *Stellaria jamesiana*, and *Fragaria vesca*. Occasionally, *Lathyrus* spp. or *Vicia americana* or both form a mat growth over this low shrub and forb complex. Annuals were often common, particularly *Nemophila breviflora*. The tall grasses, *Bromus carinatus*, *Agropyron trachycaulum*, and *Elymus glaucus*, frequently form a conspicuous part of the herb layer. At times, *Poa pratensis* is abundant.

Succession—The POTR-ABLA/SYOR/TALL FORB c.t. represents a successional stage within the *A. lasiocarpa* climax coniferous forest series, most likely within the *A. lasiocarpa / O. chilensis* habitat type (appendix E). As *A. lasiocarpa* gains increasing dominance of the tree overstory, shading intensity increases. *Populus tremuloides* fails to sucker, and the highly productive and diverse undergrowth changes to a less complex assemblage of species. The tall forbs, grasses, and shrubs will decrease in importance, whereas *O. chilensis*, *T. fendleri*, and *S. jamesiana* will increasingly dominate the undergrowth. Heavy grazing will usually lead to a decrease of many of the tall forbs, especially *A. urticifolia*, *A. engelmannii*, and *S. serra*, and an increase in *R. occidentalis*, *H. floribunda*, *S. jamesiana*, *F. vesca*, and possibly *Lathyrus* spp. Prolonged abusive grazing can lead to a substantial increase in *P. pratensis* and *Taraxacum officinale* or even replacement of the perennial shrubs and herbs with annuals such as *N. breviflora*, *Collomia linearis*, and *Polygonum douglasii*.

Production—All production measurements of trees indicate that the type ranks in the mid-third percentile of the Region's aspen stands. Total tree basal area averaged 149 ft^2/acre (34.1 m^2/ha); 88 percent of this was aspen and the remainder was conifers. The average site index at 80 years for aspen was 51 ft (15.4 m), with an estimated wood volume production at stand maturity of 40 ft^3/acre/year (2.9 m^3/ha/year). Both aspen reproduction at 731 suckers/acre (1,807/ha) and tree density at 699 stems/acre (1,727/ha) were in the mid-third percentile of all aspen stands.

Annual production of undergrowth was also in the mid-range of all stands, averaging 910 lb/acre (1,020 kg/ha). This was highly variable between stands, ranging from a low of 501 to a high of 1,539 lb/acre (562 to 1,725 kg/ha). Over three-fourths of this production was forbs at 46 percent and graminoids at 31 percent. The remaining 23 percent was the annual growth of shrubs. The undergrowth is in the mid-range of suitability as summer range for livestock, with an average 56 percent classified as desirable and 35 percent as intermediate. The large amount of structural diversity in the mixed aspen-conifer tree layer combined with a mixture of shrubs, forbs, and graminoids in the undergrowth suggest that this type has fairly high value as wildlife habitat.

Other—In the Utah classification (Mueggler and Campbell 1986), seral communities of this composition were classified as the *P. tremuloides—A. lasiocarpa / S. oreophilus/S. serra* c.t. Some of the communities falling in the *P. tremuloides—A. lasiocarpa / S. oreophilus* c.t. of the Caribou and Targhee National Forests classification (Mueggler and Campbell 1982) are contained in this type.

Populus tremuloides—Abies lasiocarpa/Thalictrum fendleri Community Type (POTR-ABLA/THFE c.t.)

Distribution—The POTR-ABLA/THFE c.t. is a minor community type that is widely distributed throughout the Region but is most prevalent in the northern part. The type accounts for 4 percent of the aspen stands on the Brider-Teton National Forest in Wyoming and 3 percent on the Wasatch-Cache and Manti-LaSal National Forests in Utah. The type was observed as far south as the Markagunt Plateau in southern Utah. It also occurs in the Jarbidge and Schell Creek Ranges in Nevada. This is a moderately high elevation type with 90 percent of the stands above 7,000 ft (2,100 m). The type occurred as high as 10,100 ft (3,080 m) on the Manti-LaSal. The type occupies slopes of all exposures and steepness but usually at the mid-slope position. Two-thirds of the stands occupy soils of sedimentary parent rock, primarily sandstones.

Vegetation—The POTR-ABLA/THFE c.t. is characterized by a tree layer in which *Abies lasiocarpa* or *Picea engelmannii* or both are prominent along with *Populus tremuloides* and by a relatively simple undergrowth consisting primarily of low-growing forbs. The prominence of conifers in the tree layer may take the form of reproduction that has not yet reached the height of the tree canopy, which is dominated by *P. tremuloides*. Although a shrub stratum per se is absent, minor amounts of shrubs are frequently present. The most common of these are *Symphoricarpos oreophilus*, *Pachystima myrsinites*, and *Berberis repens*. The undergrowth is dominated primarily by such forbs as *Thalictrum fendleri*, *Osmorhiza chilensis*, and *Geranium viscosissimum*. Less common, but at times relatively abundant when present, are *Lathyrus* spp., *Lupinus argenteus*, *Arnica cordifolia*, *Stellaria jamesiana*, and *Fragaria vesca*. The most common graminoids in this type are *Agropyron trachycaulum*, *Carex rossii*, and *Bromus carinatus*, but they are seldom abundant. Annual species are rather scarce.

Succession—Given time, the normal course of succession is toward dominance of the tree stratum by *A. lasiocarpa*. Thus, the POTR-ABLA/THFE c.t. is a seral type within the *A. lasiocarpa* climax forest series. Comparisons of constancy of important species suggest that it is most likely a seral stage within the *A. lasiocarpa / O. chilensis* habitat type (Mauk and Henderson 1984; Steele and others 1983). The effects of heavy grazing could cause an increase in such herbaceous species as *A. cordifolia*, *S. jamesiana*, *F. vesca*, *Poa pratensis*, and *Taraxacum officinale* at the expense of the more palatable or less grazing-resistant herbs.

Production—Although total tree basal area ranked in the upper quarter of all stands sampled, 205 ft^2/acre (47.0 m^2/ha), the type was only moderately good for the production of aspen. Aspen site index at 80 years averaged 49 ft (15 m), and wood volume production at stand maturity was estimated at 38 ft^3/acre/year (2.7 m^3/ha/year), both of which were in the mid-third percentile of all stands. Aspen reproduction was a moderate 1,196 suckers/acre (2,855/ha), as was total tree density at 647 stems/acre (1,598/ha). Although the normal course of succession will eventually take this type to dominance by conifers, the type does have the potential to be at least moderately productive of aspen wood fiber in the interim.

However, the potential of the type as a long-term forage resource appears to be low. Annual production of undergrowth was highly variable but averaged a meager 496 lb/acre (556 kg/ha) of air-dry herbage. This ranked in the low quarter of all stands, and is probably attributable in great part to the relative abundance of conifers (over a fourth of the tree basal area). Of the undergrowth production, 86 percent was forbs, with only 13 percent graminoids and 1 percent shrubs. This mixture is of only average suitability as livestock forage, with 47 percent in the desirable category and 45 percent intermediate. The type is thus poor summer range for livestock primarily because of meager forage production. Although the mixture of aspen and conifers in the tree stratum undoubtedly enhances the value of the type as wildlife habitat, lack of diversity in undergrowth vegetation classes makes the type of limited value as wildlife habitat.

Other—The POTR-ABLA/THFE c.t. was identified by this name in the Caribou and Targhee National Forests classification (Mueggler and Campbell 1982). However, in the Bridger-Teton National Forest classification (Youngblood and Mueggler 1981), communities of this general composition were included as part of the *P. tremuloides—A. lasiocarpa / A. cordifolia* and the *P. tremuloides—A. lasiocarpa / B. repens* types. Although aspen communities seral to *A. lasiocarpa* are common in Colorado (Johnston and Hendzel 1985), communities with this general composition have not been specifically identified there.

Populus tremuloides—Pinus contorta/ Juniperus communis Community Type (POTR-PICO/JUCO c.t.)

Distribution—The POTR-PICO/JUCO c.t. is a local type primarily in the Uinta Mountains of northeastern Utah. It is the second most frequent type on the Ashley National Forest (8 percent of all aspen communities), and is especially abundant on the north and south slopes of the Uintas. The type occurred elsewhere in the Intermountain Region only on the Wind River and Wyoming Ranges in Wyoming and on the Wasatch Range in Utah. It was not observed farther south in Utah nor was it seen in Nevada. This is a fairly high elevation type. Over 90 percent of the stands were at elevations over 8,000 ft (2,400 m). These usually occurred on less than 25 percent slopes and on all exposures. They were confined primarily to soils derived from sandstone and quartzite parent rock.

Vegetation—This seral community type is characterized by the prominence of *Pinus contorta* associated with *Populus tremuloides* in the tree layer and a shrub layer dominated by *Juniperus communis*. Except for the mixed aspen and conifer tree stratum, the structure of the type is fairly simple with only moderate species diversity. Other shrubs commonly associated with *J. communis* in the undergrowth are *Berberis repens*, *Arctostaphylos uva-ursi*, and *Symphoricarpos oreophilus*. This shrub layer is generally broken and patchy. The herbaceous stratum is a composite of graminoids and low-growing forbs. The most common and abundant graminoids are *Carex geyeri*, *Stipa occidentalis*, and *Agropyron trachycaulum*. *Astragalus miser* was fairly abundant in two-thirds of the 23 stands sampled. Other common forbs are *Achillea millefolium*, *Geranium viscosissimum*, *Thalictrum fendleri*, *Lupinus argenteus*, and *Taraxacum officinale*. Annuals are scarce.

Succession—The prominence of *P. contorta*, and in some instances *Abies lasiocarpa* or *Pseudotsuga menziesii*, in these communities indicates that the tree overstory will gradually convert to conifer dominance. Thus, the aspen in these stands is considered to be seral. In most cases, the *P. contorta* is likely a seral species as well. The end point in the successional process, then, would probably be either climax communities in the *A. lasiocarpa* forest series or possibly in the *P. menziesii* forest series. The type is most similar in composition to the *P. contorta / B. repens* c.t. that Mauk and Henderson (1984) suggest may be a seral stage within the *A. lasiocarpa / B. repens* habitat type. Grazing by livestock has undoubtedly changed the composition of the undergrowth, but the magnitude of these changes is difficult to ascertain. The flora probably was once more diverse and possibly more productive than it is now.

Production—This seral type was not sampled to obtain estimates of overall productivity. The type is, however, structurally and compositionally similar to the *P. tremuloides—A. lasiocarpa / J. communis* c.t., except for the tree stratum. Tree productivity for this latter type suggests that the POTR-PICO/JUCO c.t. is probably in the mid-range for all aspen types, with total tree basal areas averaging about 150 ft^2/acre (34.4 m^2/ha), aspen site index of about 55 ft (16.8 m), and volume production of approximately 45 ft^3/acre/year (3.2 m^3/ha/year). Annual production of undergrowth probably averages in the lower quarter of all stands, principally because of shading by conifers in the tree layer. Undergrowth is about 200 to 500 lb/acre (224 to 560 kg/ha) of air-dry material. This undergrowth is believed to be only moderately suitable as livestock forage. Thus, the type is considered moderately productive of wood fiber and rather poor summer range for livestock. The value of the type as wildlife habitat appears to be poor because of the lack of undergrowth production.

Other—The Utah classification (Mueggler and Campbell 1986) recognized these communities under the same type name.

Populus tremuloides—Abies concolor/ Symphoricarpos oreophilus Community Type (POTR-ABCO/SYOR c.t.)

Distribution—This is a minor seral type that occurs primarily in central Utah and east-central Nevada. It is fairly abundant on the Manti-LaSal and the Fishlake National Forests where it accounts for 5 and 6 percent of the aspen communities, respectively. The center of the type appears to be the Wasatch Plateau. It occurs as far north as the Wasatch Range in northern Utah and as far south as the Markagunt and Aquarius Plateaus on the Dixie National Forest, and was found in Nevada only in the Snake and Schell Creek Ranges of the Humboldt National Forest. The POTR-ABCO/SYOR c.t. is an intermediate elevation type with 95 percent of the stands growing between 7,000 and 9,000 ft (2,100 and 2,700 m). These stands were on less than 40 percent slopes, on all exposures, and on soils derived from both igneous and sedimentary parent rock.

Vegetation—The vegetation is characterized by the prominence of *Abies concolor* and virtual absence of *Abies lasiocarpa* in the tree layer, with undergrowth consisting

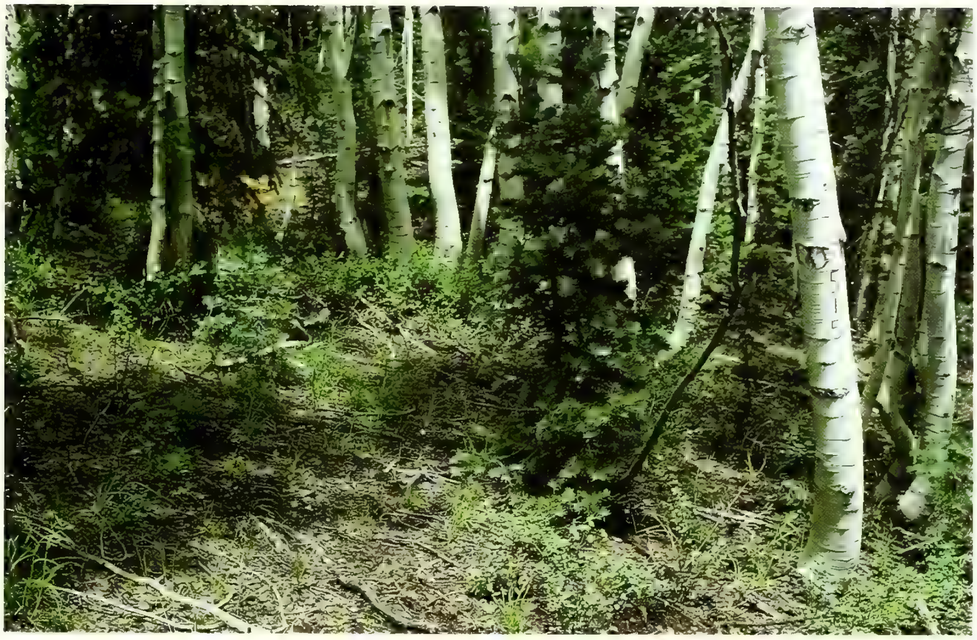

Figure 27—The *Populus tremuloides—Abies concolor/Symphoricarpos oreophilus* c.t. is a minor seral type that occurs primarily in central Utah and east-central Nevada. The presence of conifer reproduction indicates that the overstory in this type will eventually be dominated by *A. concolor.*

of a low shrub stratum and a mixed herb stratum of grasses and low forbs. The typifying and prominent shrub is *Symphoricarpos oreophilus,* with *Rosa woodsii* and *Berberis repens* also fairly common. A wide mixture of forbs and graminoids can be present, but no one species has high constancy. The most common graminoids are *Agropyron trachycaulum,* which occurred in about half of the 32 stands, and *Bromus carinatus* and *Stipa occidentalis,* which were present in about a third of the stands. The most common forbs are *Osmorhiza chilensis* and *Stellaria jamesiana,* in about two-thirds of the stands, and *Achillea millefolium, Thalictrum fendleri,* and *Taraxacum officinale,* in less than half the stands. Tall forbs such as *Aster engelmannii, Agastache urticifolia, Mertensia arizonica, Senecio serra,* and *Rudbeckia occidentalis* were occasionally conspicuous. Annuals were seldom prominent.

Succession—Given time and freedom from disturbance, stands within the POTR-ABCO/SYOR c.t. will eventually succeed to dominance by *A. concolor* (fig. 27). Judging from comparisons of species constancies (appendix E), the type is most likely a seral stage within the *A. concolor / B. repens* habitat type. Livestock grazing has had considerable impact on some stands as suggested by the presence of, but lack in abundance of, such tall forbs as *A. engelmannii, A. urticifolia, Hackelia floribunda, S. serra,* and *M. arizonica,* and the relative abundance of less palatable species. Under heavy cattle grazing, an increase in *R. occidentalis* and possibly *Lathyrus* spp. can be expected at the expense of the more palatable grasses and forbs. Heavy sheep use is expected to suppress *S. oreophilus* as well as the palatable tall forbs, and the production of grasses should be enhanced.

Production—Tree basal area ranked in the upper quarter of all aspen stands. The four stands sampled for production averaged 199 ft^2/acre (45.6 m^2/ha). An average 62 percent of this was aspen and the remainder was conifers. The growth rate of aspen, however, appears to be low. Aspen site index at 80 years averaged only 37 ft (11.2 m), and estimated aspen volume growth at stand maturity averaged only 22 ft^3/acre/year (1.5 m^3/ha/year). Both of these growth measurements were in the lower quarter percentile of all stands. Tree density was better than average at 938 stems/acre (2,317/ha), but aspen reproduction was a low 113 suckers/acre (279/ha). Therefore, the type does not appear particularly well suited for the production of aspen wood fiber even though it is able to support substantial tree basal area.

Undergrowth production was also meager, averaging only 310 lb/acre (348 kg/ha). This was in the lowest tenth percentile of all aspen stands and is probably caused largely by the relative abundance of conifers in the tree layer which intensifies shading of the undergrowth. Shrubs were 50 percent of this undergrowth, forbs 49 percent, and graminoids only 1 percent. The undergrowth appears about average in value as forage, with 55 percent of the cover ranking as desirable and 41 percent as intermediate. The type is poor summer range for livestock, especially cattle, because of the low overall productivity and lack of graminoids. The mixture of aspen and conifers in the overstory plus the large proportion of shrubs in the undergrowth suggest that the type is fair to good habitat for wildlife.

Other—The Utah classification (Mueggler and Campbell 1986) treats communities of this composition and structure under the same type name.

INCIDENTAL ASPEN COMMUNITY TYPES

Populus tremuloides/Veratrum californicum Community Type (POTR/VECA c.t.)

Distribution—This scarce yet identifiably unique community type is described on the basis of seven stands in Utah and Nevada. In Utah, one of these stands was on the northwest slope of the Uinta Mountains in the upper Bear River drainage, one was just east of Salt Lake City in the Wasatch Range, and one was in the San Pitch Mountains east of Santaquin. In Nevada, the type was observed in the Santa Rosa, Independence, and Jarbidge Ranges of the Humboldt National Forest in the northern part of the State. Most of these stands were at elevations between 7,000 and 8,000 ft (2,100 and 2,400 m). They grew on gently sloping, concave land surfaces that were usually very moist sites with relatively poor drainage and deep, heavy soils.

Vegetation—The vegetation of the POTR/VECA c.t. is characterized by the prominence of the conspicuously tall and coarsely robust forb, *Veratrum californicum* (fig. 28). Conifers are seldom present and never prominent. Shrubs also are never prominent, although such species as *Salix scouleriana*, *Rosa woodsii*, and especially *Symphoricarpos oreophilus* may be present in small quantities. The tall forb *Mertensia arizonica* is an important associate in almost three-fourths of the stands, and the low forb *Stellaria jamesiana* was readily apparent in most of the stands. Other forbs frequently encountered in this type are *Valeriana occidentalis, Hackelia floribunda*, and *Rudbeckia occidentalis*. *Senecio serra* is occasionally abundant. Graminoids are seldom abundant. The most frequent ones, are *Bromus carinatus*, *Agropyron trachycaulum*, and *Carex hoodii*. Annuals, especially *Nemophila breviflora*, are frequently abundant.

Succession—This relatively rare type appears to be stable in a specialized habitat that is very moist, particularly early in the growing season. The soil remains saturated with water for an extended period following snow-melt because of runoff and subsurface seepage from up-slope areas. *Veratrum californicum* appears well adapted to these sites, but the persistence of aspen is somewhat questionable. Aspen reproduction does not appear to do well if the site remains wet for too long, as evidenced by dense *V. californicum* stands lacking aspen adjacent to less dense stands of *V. californicum* with an aspen overstory. Heavy, prolonged grazing discourages the relatively few palatable graminoids and forbs and promotes the dominance of *V. californicum* and annuals.

Production—The single stand sampled for productivity suggests that although tree basal area may be low, aspen growth is rapid. Tree basal area was 71 ft^2/acre (16.4 m^2/ha) and aspen site index at 80 years was 67 ft (20.4 m). Aspen volume growth at stand maturity was estimated as 61 ft^3/acre/year (4.3 m^3/ha/year). Both these productivity measurements are in the upper tenth of all aspen stands sampled for production in the Region. Aspen reproduction in this one stand was good at 1,583 suckers/acre (5,732/ha), but tree density was low at 400 stems/acre (988/ha), which reflects the low stand basal area.

Undergrowth production can be high because lack of soil moisture seldom restricts plant growth. The sampled

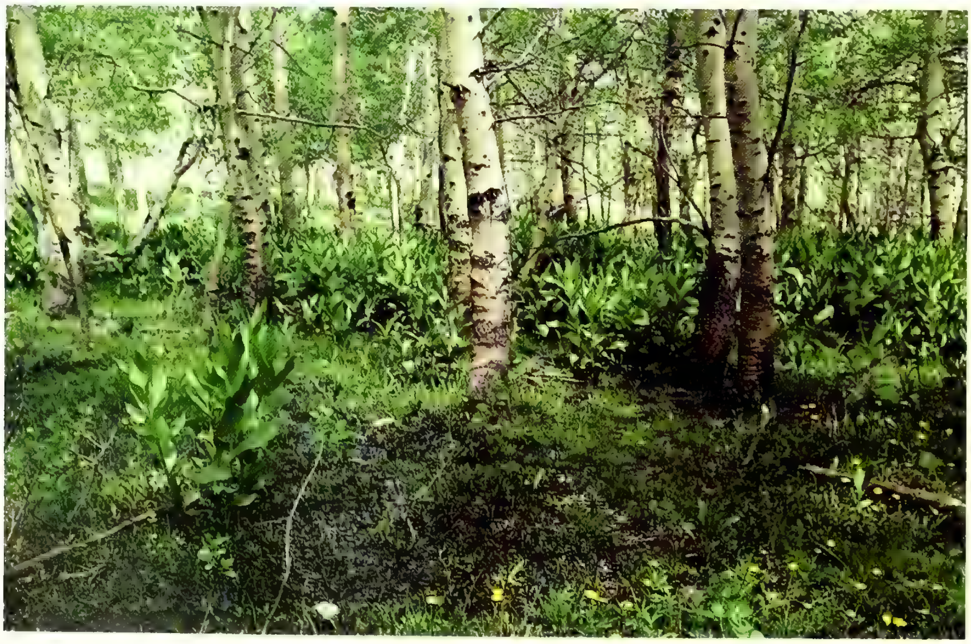

Figure 28—The *Populus tremuloides/Veratrum californicum* c.t. is an infrequent but vegetationally distinct type encountered in both Utah and Nevada. The robust undergrowth dominant, *V. californicum*, is indicative of moist, poorly drained site conditions.

stand produced 1,583 lb/acre (1,775 kg/ha), which was in the upper quarter percentile of all stands. Forbs accounted for 34 percent of this production, graminoids 65 percent, and the remaining 1 percent was shrubs. This ratio of forbs to graminoids is somewhat atypical for this type. The proportion of forbs is generally much greater than that of graminoids because of the usual abundance of the robust forb *V. californicum*. Because of species composition, the type is poor for livestock grazing, despite the abundance of undergrowth. Only 56 percent of the vegetation cover was classified as desirable and intermediate forage. This can be misleading when applied to all stands within the type because *V. californicum* has the potential to exclusively dominate the undergrowth on some sites. When this occurs, the lush undergrowth has little value as livestock forage. Lack of structural and species diversity limits the value of this type as wildlife habitat.

Other—Aspen communities similar to this were recognized under this name in the Utah classification (Mueggler and Campbell 1986). Although the type is scarce, it appears to be fairly widespread. Hoffman and Alexander (1980) described a *P. tremuloides / Veratrum tenuipetalum* habitat type on the Routt National Forest in northwestern Colorado, and Johnston and Hendzel (1985) described a climax aspen type with this name on the San Juan National Forest in southern Colorado. According to Harrington (1954), *V. tenuipetalum* and *V. californicum* are synonymous.

Johnston and Hendzel (1985) mentioned that snow damage to aspen suckers in this type can be great, especially in clearcuts. They also observed that all of the aspen suckers (5 years old) in one such stand were killed by an unknown disease, and they speculated that the disease might be related in some way to the characteristic saturated soils of the type.

Populus tremuloides/Rubus parviflorus Community Type (POTR/RUPA c.t.)

Distribution—Only four stands within this community type were encountered, each on a different National Forest in the northern part of the Region. One was in the Wind River Range of the Bridger-Teton, one in the Webster Range of the Caribou, one in the Wasatch Range of the Wasatch-Cache, and one at the west end of the Uinta Mountains on the Uinta National Forest. All were observed at fairly high elevations for this far north, between 8,000 and 9,300 ft (2,400 and 2,800 m). All occupied either mid or upper slope positions of fairly steep slopes, ranging from 26 to 65 percent. They did not appear to be otherwise confined by either exposure or soil parent material.

Vegetation—This low shrub undergrowth type is characterized by the overwhelming prominence and dominance of the broad-leaved shrub *Rubus parviflorus* beneath the *Populus tremuloides* tree layer. Although conifers such as *Pinus contorta, Abies lasiocarpa*, and *Pseudotsuga menziesii* may occasionally be present, they do not form a prominent part of the tree stratum. Shrubs that frequently accompany *R. parviflorus* are *Pachystima myrsinites*, *Shepherdia canadensis*, and to a lesser extent *Symphoricarpos oreophilus* and *Rosa woodsii*. The herbaceous undergrowth consists primarily of low-growing forbs such as *Arnica cordifolia*, *Geranium viscosissimum*, *Castilleja linariaefolia*, and *Osmorhiza chilensis*. Sometimes *Lathyrus* spp. and *Vicia americana* are abundant. Of a wide variety of graminoids that may be present, the most common are *Elymus glaucus* and *Agropyron trachycaulum*. *Calamagrostis rubescens* and *Carex geyeri* are abundant in some stands. Annuals are usually scarce.

Succession—The successional status of this minor type is unclear. It could remain dominated by *P. tremuloides* over an extended period or, judging from the presence of some conifers, the type could slowly convert to dominance by either *A. lasiocarpa* or perhaps *P. menziesii*. Too little data are available to guess at the eventual habitat type. In any case, *R. parviflorus* will probably remain a prominent part of the undergrowth. Heavy grazing by sheep will probably reduce the abundance of *R. parviflorus*.

Production—The single stand sampled for production had a low stand basal area of 74 ft^2/acre (17.0 m^2/ha), but the growth of aspen was good, ranking in the upper 10 percent of all stands. Site index of aspen at 80 years was 65 ft (19.9 m), and estimated volume production at stand maturity was 60 ft^3/acre/year (4.2 m^3/ha/year). Both aspen reproduction and tree density ranked in the lower quarter of all stands at 219 suckers/acre (541/ha) and 348 stems/acre (860/ha), respectively. Therefore, although both stand density and basal area were low in this type, the potential of the type for the rapid growth of aspen appears to be high.

The annual production of undergrowth was a low 513 lb/acre (575 kg/ha), which ranked in the lower quarter of all stands. By far the bulk of this annual growth was of shrubs, primarily *R. parviflorus*. Forbs were only 10 percent and graminoids only 3 percent of this undergrowth. The type thus appears to provide comparatively poor summer range for livestock. The value as wildlife habitat is only moderate.

Other—Although aspen communities of this composition were observed in earlier classifications, they were so infrequent that they were not treated as a separate community type. However, they are recognized as a separate type in this classification because, even though rare, they occur over a rather broad extent of the northern part of the Region.

Populus tremuloides/Sambucus racemosa Community Type (POTR/SARA c.t.)

Distribution—This incidental community type was observed primarily in central Utah. The type was centered on the Wasatch Plateau on the Manti-LaSal National Forest, but was encountered as far north as the Bear River Range on the Wasatch-Cache National Forest and as far south as the Abajo Mountains in southeastern Utah. It was not seen in Idaho, Wyoming, or Nevada. It is a fairly high elevation type. All but one of the 11 stands sampled were above 8,000 ft (2,400 m), and one was at 10,500 ft (3,200 m). The type occurred most frequently at mid to upper positions of moderate to steep slopes. Soil parent rock varied, but almost half was limestone.

Vegetation—The conspicuous feature of this type is the prominence of the shrubs *Sambucus racemosa* or *S. cerulea* in the undergrowth (fig. 29); with the exception of *Symphoricarpos oreophilus*, other shrubs are usually scarce. The tree overstory usually consists exclusively of *Populus tremuloides*. Occasionally, *Abies lasiocarpa* may be present, but it is never abundant. The herbaceous stratum generally has a large and variable component of such tall forbs as *Polemonium foliosissimum*, *Osmorhiza occidentalis*, *Mertensia arizonica*, *Delphinium occidentale*, *Valeriana occidentalis*, *Rudbeckia occidentalis*, *Agastache urticifolia*, and *Senecio serra*. The most frequent and abundant low-growing forbs in this type are *Thalictrum fendleri* and *Stellaria jamesiana*. The graminoid component of the undergrowth is usually dominated by *Bromus carinatus*. *Agropyron trachycaulum* and *Elymus glaucus* are frequent associates. Annuals are often abundant because of soil disturbance by pocket gophers. The most common annual plants are *Galium bifolium*, *Descurainia richardsonii*, *Polygonum douglasii*, *Collomia linearis*, and *Nemophila breviflora*.

Succession—Some of the communities in this type are stable, but others may gradually succeed to overstory dominance by *A. lasiocarpa*. Heavy prolonged grazing by livestock will no doubt alter the undergrowth composition appreciably. If grazed by sheep, the shrubs and tall forbs are likely to suffer, while the graminoids and annuals increase in abundance. Heavy grazing by cattle would probably reduce the abundance of some of the more palatable grasses, especially *B. carinatus*, the shrubby *Sambucus* spp., and some of the tall forbs. In this case, *R. occidentalis*, *S. serra*, and the low forbs and annuals should increase in abundance.

Production—The POTR/SARA c.t. is moderately productive of trees, with total tree basal area in the six stands sampled for production averaging 137 ft^2/acre (31.3 m^2/ha). Site index for aspen at 80 years averaged 50 ft (15.2 m), and estimated aspen volume production at maturity averaged 39 ft^3/acre/year (2.7 m^3/ha/year). All of these tree productivity measurements are in the upper third percentile of all stands sampled for production. Both tree density and aspen reproduction were about normal for aspen stands in the Region, averaging 556 stems/acre (1,374/ha) and 696 suckers/acre (1,720/ha). The type is somewhat better than average for the production of wood fiber.

The undergrowth generally consists of a more productive than average mixture of grasses, forbs, and shrubs. Annual production of air-dry herbage averaged 1,130 lb/acre (1,267 kg/ha), which is in the upper third of all stands. Forbs were 45 percent of this production, graminoids 35 percent, and shrubs 20 percent. This undergrowth was also above average in its suitability as livestock forage, with 48 percent classified as desirable and 46 percent as intermediate. The type thus is both good summer range for livestock and good habitat for wildlife.

Other—Aspen communities of this composition and structure were named the same in the earlier Utah aspen

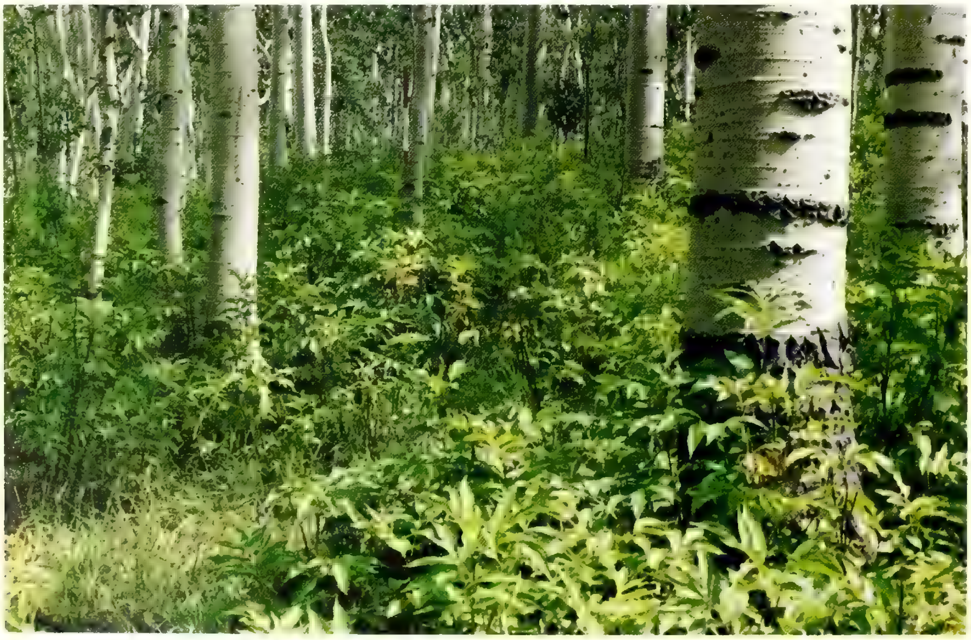

Figure 29—The *Populus tremuloides/Sambucus racemosa* c.t. is an infrequent, stable aspen type observed most often in central Utah. The principal distinguishing feature is the prominence of the shrubs *S. racemosa* or *S. cerulea* under an aspen overstory.

classification (Mueggler and Campbell 1986). This type has not been reported to occur outside of the Intermountain Region.

Populus tremuloides/Salix scouleriana Community Type (POTR/SASC c.t.)

Distribution—The POTR/SASC c.t. appears to be restricted to the northern half of the Region. It occurred on the Yellowstone Plateau in eastern Idaho, on the Bear River and Wasatch Ranges in northern Utah, and in the mountains of northeastern Nevada. Although the type is seldom encountered elsewhere, it is most common in northeastern Nevada where it comprises 3 percent of the aspen communities on the Humboldt National Forest. It is a comparatively low elevation type. The 13 stands examined were at elevations ranging from 5,800 to 7,400 ft (1,800 to 2,300 m). The majority of these stands occupied mid-slope positions on moderately steep north- and east-facing slopes. They occurred on soils derived from a broad range of parent materials.

Vegetation—The primary distinguishing feature of this type is the prominence of *Salix scouleriana* in a tall shrub stratum below the *Populus tremuloides* overstory. No conifers were observed in any of the stands. The shrub stratum is variable but at times can be fairly dense with considerable amounts of *Amelanchier alnifolia* or *Prunus virginiana* associated with the *S. scouleriana*. Low shrubs are also frequently present, particularly *Symphoricarpos oreophilus* and *Rosa woodsii*. The herbaceous stratum usually consists of a mixture of graminoids, tall forbs, low forbs, and annuals. Low forbs usually predominate, especially *Osmorhiza chilensis* and *Thalictrum fendleri*. The most frequently encountered tall forbs are *Agastache urticifolia*, *Senecio serra*, and *Hackelia floribunda*. *Epilobium angustifolium* was more common in this type than in most of the other community types. Common grasses are *Elymus glaucus* and *Bromus carinatus*. Annuals were abundant in some of the stands, particularly *Nemophila breviflora* and *Galium bifolium*.

Succession—Although no evidence showed that stands within this type will succeed to conifer dominance, the sites appear moist enough to support conifers. Even though the type may appear relatively stable, the long-term successional status is thus obscure. The continued presence of *S. scouleriana* in the shrub stratum over an extended period is questionable. Both *S. scouleriana* and *E. angustifolium* are species that establish especially well from seed following fire. Whether these two species will be able to regenerate in these stands without this type of disturbance is uncertain. Where *Salix* decreases in abundance with time, a stand in this type would eventually be categorized in either the POTR/AMAL/THFE c.t. or POTR/AMAL/TALL FORB c.t.

Production—No stands in the POTR/SASC c.t. were sampled for production. Judging from stand structure, species composition, and field observations, the type makes wildlife habitat. The abundance of tall and low-growing shrubs provides not only ample browse but excellent hiding cover as well. Suitability as livestock range appears to be only moderate because the dense shrubby undergrowth tends to hamper livestock movement. The potential for the production of wood fiber is unknown and probably unimportant because the type does not occur in any abundance.

Other—This community type has not been described previously.

Populus tremuloides/Pteridium aquilinum Community Type (POTR/PTAQ c.t.)

Distribution—This unusual and distinct type was observed on three National Forests within the Region: Wasatch-Cache, Uinta, and Dixie. The principal location of the 13 stands sampled was the Wasatch Range between Salt Lake City and Heber City, UT. One stand was seen as far south as the Markagunt Plateau in southern Utah. The stands in northern Utah were at elevations between 5,800 and 8,400 ft (1,800 and 2,600 m). The stand in southern Utah was at 9,350 ft (2,850 m). The type generally occupied mid-slope positions of moderate to steep slopes, two-thirds of which were of easterly exposure. Most of these stands occupied soils of sandstone parent rock, but some were found on granitics.

Vegetation—The vegetation differs from the somewhat similar *Populus tremuloides / Amelanchier alnifolia / Pteridium aquilinum* c.t. by the lack in abundance of shrubs. Such shrubs as *Symphoricarpos oreophilus* or *Sambucus racemosa* may occasionally be present, but they are not prominent. The tree stratum usually is exclusively *P. tremuloides*. Conifers are seldom present and then only in incidental amounts. The predominantly herbaceous undergrowth is overwhelmingly dominated by the distinctive fern, *Pteridium aquilinum* (fig. 30). This is frequently accompanied by such tall-growing forbs as *Rudbeckia occidentalis*, *Agastache urticifolia*, *Aster engelmannii*, and *Senecio serra* . The most common low forbs are *Osmorhiza chilensis* and *Thalictum fendleri*. Graminoids such as *Elymus glaucus* and *Bromus carinatus* are usually intermixed with these forbs. Annuals can be abundant.

Succession—The lack of conifers suggests that the overstory will remain dominated by aspen. However, the successional status of the undergrowth is uncertain. *Pteridium aquilinum* is a native species distributed sporadically throughout the West. Where it does occur, it is usually a dominant part of the undergrowth. Thus, it may indicate a specific site situation, and such stands may represent more or less stable conditions or climax community types. On the other hand, *P. aquilinum* is not only unpalatable to livestock and reproduces readily by creeping rhizomes, but it appears to be allelopathic. Overgrazing that inhibits the growth of palatable forage species would encourage the growth and reproduction of *P. aquilinum*. Judging from undergrowth composition, then, this type might also represent a grazing-degraded

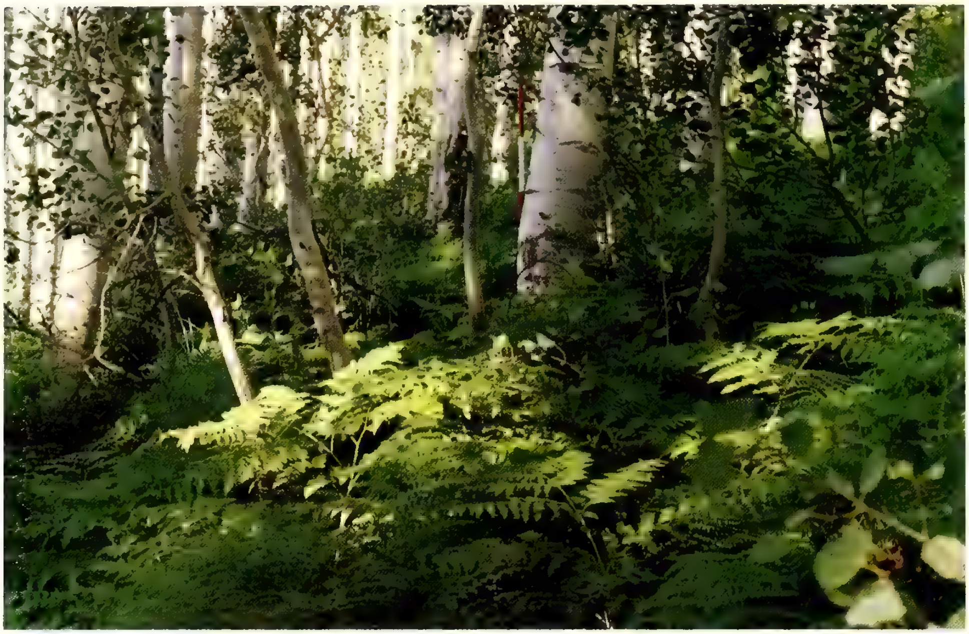

Figure 30—The distinctive *Populus tremuloides/Pteridium aquilinum* c.t., though seldom encountered, is widespread in both the Intermountain and Rocky Mountain Regions. The predominantly herbaceous undergrowth is overwhelmingly dominated by the fern *P. aquilinum*.

seral stage of a POTR/TALL FORB climax community type. In either event, abusive grazing will tend to encourage dominance of *P. aquilinum* and *R. occidentalis* at the expense of such forage species as *B. carinatus*, *E. glaucus*, *A. engelmannii*, and *A. urticifolia*.

Production—Five stands were sampled in the POTR/PTAQ c.t. to obtain an estimate of productivity. The potential of the type for the production of trees is considerably above average. Although total stand basal area averaged only a moderate 146 ft^2/acre (33.6 m^2/ha), average site index for aspen, 57 ft (17.5 m), and volume growth for aspen at stand maturity, 49 ft^3/acre/year (3.4 m^3/ha/year), were in the upper quarter of all stands sampled in the Region. Average density of trees, 1,108 stems/acre (2,737/ha) and aspen reproduction, 7,658 suckers/acre (18,924/ha), were also in the upper quarter percentile. Thus, the type is very productive of wood fiber.

Although undergrowth production is generally high in this type, it is of relatively low value as livestock forage. Annual growth of herbaceous material averaged 1,571 lb/acre (1,762 kg/ha), which is in the upper quarter of all stands. Over 90 percent of this was forbs, primarily the unpalatable *P. aquilinum*. Of the total undergrowth cover 51 percent was in the least desirable forage suitability class. The type also has fairly low value as wildlife habitat because of its lack of structural diversity and low abundance of palatable species.

Other—This type was recognized by this name in the Utah aspen classification (Mueggler and Campbell 1986). It also occurs in Colorado and is identified as the *P. tremuloides / P. aquilinum* habitat type by Hoffman and Alexander (1980, 1983). The main difference in the Colorado communities is the occurrence of substantial amounts of *Carex geyeri* in most stands.

Populus tremuloides/Amelanchier alnifolia/Pteridium aquilinum Community Type (POTR/AMAL/PTAQ c.t.)

Distribution—Except for a single stand in the Pine Valley mountains of the Dixie National Forest in southwestern Utah, this minor but unique community type appears to be confined primarily to the northern part of Utah, especially along the Wasatch Range, and with an additional example on the south slope of the Uinta Mountains. The type was not encountered in Idaho, Wyoming, or Nevada. Most of the 10 stands examined were growing at elevations below 7,000 ft (2,100 m). The sites were primarily northerly and easterly exposures, tending toward the lower slope positions, and mostly on soils derived from sandstones.

Vegetation—The POTR/AMAL/PTAQ c.t. is differentiated from the POTR/PTAQ c.t. by the relative abundance of tall shrubs in the undergrowth. The tree layer is almost exclusively *Populus tremuloides*. *Abies concolor* or *A. lasiocarpa* may be present in the tree layer or as reproduction but not in such abundance as to suggest eventual replacement of aspen dominance in the overstory. The tall shrub stratum is dominated either by *Acer grandidentatum*, *Prunus virginiana*, *Amelanchier alnifolia*, or a combination. Low shrubs, usually *Symphoricarpos* *oreophilus*, *Rosa woodsii*, or *Berberis repens*, are also frequently present, sometimes in substantial amounts. The most distinctive feature is the abundance of *Pteridium aquilinum* in the herbaceous undergrowth. This fern usually dominates the herb layer but is frequently accompanied by members of the tall forb group. Low forbs, usually *Osmorhiza chilensis*, *Smilacina stellata*, and *Galium borealis*, and grasses such as *Elymus glaucus* and *Bromus carinatus* are generally a conspicuous part of the herb layer. Annual plants are often fairly abundant.

Succession—The lack of conifers suggests that this is a stable aspen type. However, the successional status of the undergrowth is uncertain. The type may be a grazing-degraded form of the POTR/AMAL/TALL FORB c.t., with which it has many species in common. *Pteridium aquilinum* is not only unpalatable to livestock, it can be poisonous to cattle when eaten in quantity. This unpalatability combined with its ability to spread by creeping rhizomes suggests that it is likely to increase greatly in abundance if its palatable associates are depleted by prolonged excessive grazing. On the other hand, seldom if ever does *P. aquilinum* occur as a minor member of a community. It either tends to dominate the undergrowth or it is absent. This restricted distribution combined with abundance where it does occur suggests that it may have rather specific, and as yet undefined, environmental requirements and represents a distinct climax community type.

Production—Five stands were sampled to determine productivity. The type is similar to the POTR/PTAQ c.t. in that, although total tree basal area was a moderate 136 ft^2/acre (31.2 m^2/ha), both aspen site index at 80 years, 57 ft (17.3 m), and estimated aspen volume growth at stand maturity, 48 ft^3/acre/year (3.4 m^3/ha/year), were in the upper quarter of all stands. Although aspen reproduction averaged a high 1,897 suckers/acre (4,688/ha), tree density was only moderate at 833 stems/acre (2,058/ha). The potential for the production of wood fiber, then, was well above average for all aspen stands.

The potential for undergrowth production was high, averaging 2,070 lb/acre (2,320 kg/ha), which was in the upper tenth percentile of all stands. This varied greatly between stands, ranging between 837 and 3,796 lb/acre (938 and 4,256 kg/ha). One stand produced the greatest amount of undergrowth measured in this study. The bulk of the undergrowth consisted of forbs, 87 percent, most of which was the unpalatable *P. aquilinum*. Overall suitability of the undergrowth as livestock forage was low; 36 percent of the cover was classified as desirable, 30 percent as intermediate, and a very high 34 percent as least desirable. Although this type may have considerable wildlife habitat benefits because of its multilayered cover of trees, tall shrubs, and herbs, livestock grazing values are poor to moderate because of the amount of unpalatable species.

Other—This type was previously identified in the Utah classification as the *P. tremuloides / A. grandidentatum / P. aquilinum* c.t. (Mueggler and Campbell 1986). Aspen communities containing an abundance of *P. aquilinum* in the undergrowth have also been identified in northwestern Colorado on the west slope of the Park Range by Bunin (1975) and on the White River National Forest by Hoffman and Alexander (1980). Neither of these reports indicated the presence of a tall shrub stratum. Hoffman and Alexander (1980), however, do describe a *P. tremuloides / P. aquilinum* habitat type for the Routt National Forest in which almost half of the stands contain a tall shrub stratum of *A. alnifolia* or *P. virginiana* or both, a low shrub layer, and an herb layer containing species typical of our POTR/AMAL/PTAQ c.t. The most conspicuous difference was the abundance of *Carex geyeri* in their stands and absence of this sedge in ours.

Populus tremuloides/Festuca thurberi Community Type (POTR/FETH c.t.)

Distribution—Although this is an incidental type Region-wide, it is important locally in southern Utah. The POTR/FETH c.t. accounts for 8 percent of the aspen communities on the Dixie National Forest and 6 percent on the Fishlake National Forest. Most of the stands were observed on the Aquarius and Fishlake Plateaus. The type was not recorded for any of the other National Forests within the Region. The 18 stands examined ranged in elevation between 8,000 and 9,900 ft (2,400 and 3,000 m), which is about average for aspen communities at this latitude. The type occurred on relatively gentle slopes, less than 25 percent concave. It occupied soils derived from either volcanic or granitic parent rock.

Vegetation—The vegetation structure of this type is comparatively simple, consisting of a tree layer almost exclusively of *Populus tremuloides* and a predominantly herbaceous undergrowth in which the tussock grass *Festuca thurberi* is prominent (fig. 31). *Abies lasiocarpa* and *Picea engelmannii* are occasionally present either in the overstory or as reproduction, but these conifers are not a prominent part of the tree layer. Shrubs, particularly *Symphoricarpos oreophilus*, are sometimes present but never abundant. The relative lack in abundance of shrubs is what separates this type from the otherwise similar *P. tremuloides / S. oreophilus / F. thurberi* c.t. The grasses most commonly associated with *F. thurberi* in the undergrowth are *Stipa occidentalis* and *Agropyron trachycaulum*. Occasionally, *Bromus carinatus* or *Poa pratensis* may be abundant. Forbs are seldom abundant, and few have high constancy. The most common forbs are *Achillea millefolium* and *Taraxacum officinale*. In a few cases, *Lathyrus* spp. dominates the undergrowth. Ordinarily, annual plants are rather scarce.

Succession—The POTR/FETH c.t is basically a climax aspen type. However, the presence of conifers in some stands suggests the possibility of replacement by *A. lasiocarpa* or *P. engelmannii* if the reproduction of these trees is sufficient to occupy the site. Many of the stands have undergone considerable grazing pressure, judging from the amount of *T. officinale, P. pratensis*, and *Lathyrus* spp.

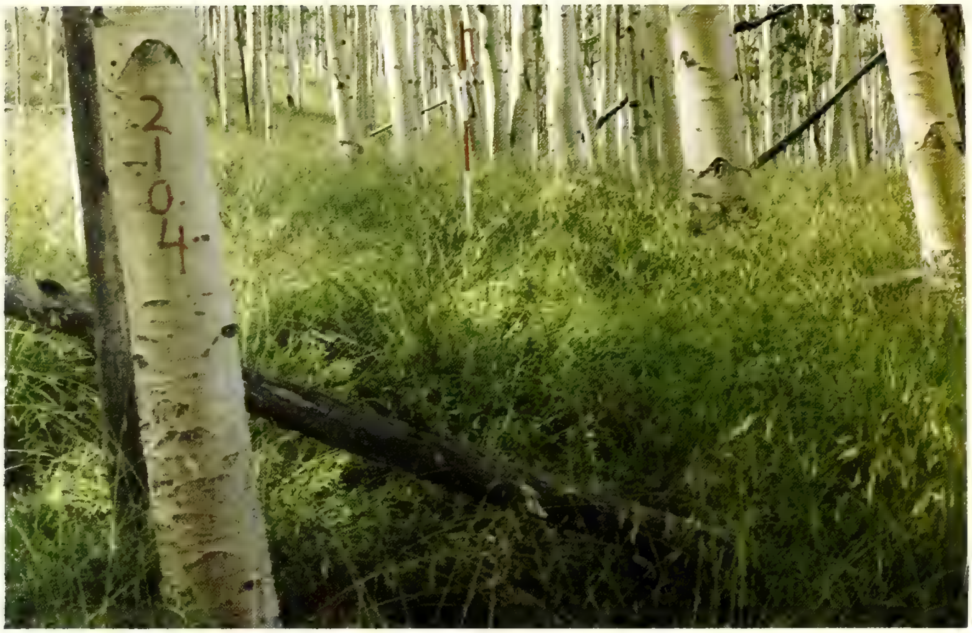

Figure 31—Though not encountered elsewhere in the Region, the *Populus tremuloides/Festuca thurberi* c.t. is a conspicuous type on the Fishlake and Aquarius Plateaus of southern Utah. The predominantly herbaceous undergrowth has an abundance of the distinctive and productive tussock grass *F. thurberi.*

Possibly these stands had at one time appreciably more *S. oreophilus,* which was reduced to present levels by sheep grazing. Such stands are a seral stage of a climax POTR/SYOR/FETH c.t. Heavy sheep use probably would not greatly reduce the amount of *F. thurberi,* unless such use was extreme. Heavy cattle use would tend to reduce the amount of *F. thurberi* and support an increase in *P. pratensis* and the remaining forbs.

Production—The POTR/FETH c.t. appears to have above-average potential for the production of trees. Total tree basal area for the six stands sampled for production averaged 224 ft^2/acre (51.4 m^2/ha), which is in the upper 25 percent of all aspen stands. Average site index for aspen at 80 years was 56 ft (17.0 m), and estimated volume growth at stand maturity was 47 ft^3/acre/year (3.3 m^3/ha/year), which is well in the upper third percentile of all stands. Aspen reproduction was moderate at 1,396 suckers/acre (3,450/ha), but tree density was well above normal at 1,074 stems/acre (2,653/ha).

Annual production of undergrowth varied greatly between stands from 289 to 3,496 lb/acre (324 to 3,919 kg/ha) and averaged a moderate 1,064 lb/acre (1,193 kg/ha). Interestingly, one stand produced close to the greatest amount of annual herbage of any aspen stand sampled, and this consisted primarily of grasses. However, average composition of the undergrowth was 56 percent graminoids, 43 percent forbs, and 1 percent shrubs. This was of about average suitability as livestock forage, with 52 percent in the desirable category and 43 percent intermediate. Considering the level of productivity and high proportion of graminoids, the type is good summer range for livestock, particularly for cattle. Lack of a shrub complex, which contributes greatly to structural diversity, limits the type's value as wildlife habitat.

Other—The POTR/FETH c.t. was described in the Utah classification (Mueggler and Campbell 1986) under this name. It also has been reported to occur in central and western Colorado. Hess and Alexander (1986) identified a *P. tremuloides / F. thurberi* habitat type on the Arapaho and Roosevelt National Forests and Johnston and Hendzel (1985) reported a similar type for the Gunnison and White River National Forests. According to Johnston and Hendzel, this type occurs either as islands in sagebrush or grasslands, or as small stands at the forest-grassland ecotones. They suggest that these stands will reproduce vigorously if clearcut or burned and possibly expand into surrounding grasslands or shrublands.

Populus tremuloides/Symphoricarpos oreophilus/Festuca thurberi Community Type (POTR/SYOR/FETH c.t.)

Distribution—Distribution of this incidental type is similar to that of the POTR/FETH c.t. It was observed only on the Fishlake and Aquarius Plateaus of southern Utah. Only seven stands were sampled, all at elevations between 8,000 and 9,400 ft (2,400 and 2,900 m), about average for aspen communities in southern Utah. The stands were on gentle to moderate slopes that were generally concave. The type occurred only on soils derived from volcanic or granitic parent rock.

Vegetation—The primary difference between this type and the POTR/FETH c.t. is the presence of a distinct layer of low shrubs beneath the *Populus tremuloides* canopy. This shrub stratum is primarily *Symphoricarpos oreophilus* and *Rosa woodsii*. The herbaceous stratum is characterized by the conspicuous presence of the tussock grass *Festuca thurberi*. Other common grasses are *Bromus anomalus, Stipa occidentalis,* and *Agropyron trachycaulum*. Although forbs generally are not abundant, *Taraxacum officinale, Achillea millefolium,* and *Thalictrum fendleri* appear in most stands. At times, *Vicia americana* or *Lathyrus* spp. are abundant. Annuals are usually scarce.

Succession—The aspen overstory appears relatively stable. The few stands sampled, however, reflect what appears to be the result of considerable grazing pressure, judging from the abundance of *T. officinale, V. americana,* and *Lathyrus* spp. Heavy grazing by sheep would tend to further reduce the amount of palatable forbs and shrubs and benefit the graminoids and *T. officinale*. Heavy use by cattle would probably reduce the amount of *F. thurberi* and *B. anomalus* and tend to favor such forbs as *V. americana, Lathyrus* spp., and *T. officinale.*

Production—The single stand sampled for productivity suggests that it is slightly less productive than the similar POTR/FETH c.t. Stand basal area was 178 ft^2/acre (40.9 m^2/ha), aspen site index at 80 years was 49 ft (15.0 m), and aspen volume production at stand maturity was 38 ft^3/acre/year (2.7 m^3/ha/year). Tree density was a moderate 735 stems/acre (1,816/ha), but aspen reproduction was low. The wood-producing potential of the type, therefore, appears to be in the mid-range for aspen in the Region.

Undergrowth production in this single example was a modest 775 lb/acre (869 kg/ha). The main difference in undergrowth between this type and the POTR/FETH c.t. is the relative proportion of shrubs and graminoids. The abundance of graminoids, particularly *F. thurberi,* is much reduced in the POTR/SYOR/FETH c.t. and is replaced by shrubs, primarily *S. oreophilus*. The suitability of this undergrowth as forage is about average for aspen communities, with 52 percent of the cover identified as desirable and 40 percent as intermediate. The type is at least moderately good livestock summer range and better than the POTR/FETH c.t. for sheep because of the abundance of palatable shrubs. Wildlife habitat values are fairly good, a reflection of the structural diversity of the vegetation.

Other—This incidental type was recognized by this name in the Utah aspen classification (Mueggler and Campbell 1986). Some of the aspen communities in west-central Colorado described by Langenheim (1962) contained a low shrub stratum dominated by *S. oreophilus* and an herbaceous layer with appreciable amounts of *F. thurberi.*

Populus tremuloides/Symphoricarpos oreophilus/Carex rossii Community Type (POTR/SYOR/CARO c.t.)

Distribution—This infrequent community type is widely scattered across the Region from as far north as the Wyoming Range on the Bridger-Teton National Forest, as far south as the Aquarius Plateau on the Dixie National Forest, and as far west as the Monitor Range on the Toiyabe National Forest. The greatest concentration is in southern Utah on the Fishlake and Dixie National Forests. Except for the high plateaus of southern Utah and the Monitor Range in central Nevada, the type is seldom encountered elsewhere in the Region. This is a fairly high elevation community type. All 18 of the stands sampled occurred over 8,500 ft (2,600 m). Most were on less than 25 percent slopes, occupied all exposures, but were restricted almost exclusively to soils derived from granitic or volcanic parent rock.

Vegetation—The POTR/SYOR/CARO c.t. is similar to the comparatively common POTR/CARO c.t. in that the herbaceous undergrowth is characterized by the prominence of the graminoids *Carex rossii* or *Bromus anomalus* and either the complete absence or at least lack of prominence of graminoids and forbs that serve to characterize other aspen types. It differs from the POTR/CARO c.t. by the presence of a low shrub stratum, which consists primarily of *Symphoricarpos oreophilus*. Other graminoids frequently present are *Stipa occidentalis* and *Agropyron trachycaulum*. This type does not usually have a great variety of different forbs. The most common and usually most abundant are *Lupinus argenteus* and *Taraxacum officinale*. Occasionally, *Astragalus miser* or *Arnica cordifolia* may be abundant. Annuals are generally scarce. Although the tree stratum is usually only *Populus tremuloides*, such conifers as *Pseudotsuga menziesii, Abies concolor*, or *Abies lasiocarpa* may be present in minor quantities.

Succession—Many of the 18 stands sampled lacked any evidence of invasion by conifers and thus should probably be considered stable aspen communities. Others appear susceptible to dominance by conifers, judging from the presence and potential increase of such species as *A. lasiocarpa* and *P. menziesii*. In such cases, the direction of succession of the POTR/SYOR/CARO c.t. would probably be toward a POTR-ABLA/CARO c.t., which appears to be a seral stage within the *A. lasiocarpa / C. rossii* habitat type described by Youngblood and Mauk (1985). Excessive grazing in the past likely contributed to the lack of species diversity in the undergrowth.

Production—The production potential of this type was estimated on the basis of three stands. The ability to produce trees is in the mid-range of all aspen stands, with total basal area averaging 156 ft^2/acre (35.8 m^2/ha), site index for aspen averaging 46 ft (14.0 m), and estimated volume growth of aspen at stand maturity averaging 34 ft^3/acre/year (2.4 m^3/ha/year). Tree density, however, was in the upper third percentile at 902 stems/acre (2,229/ha).

Annual production of undergrowth in the POTR/SYOR/CARO c.t. is considerably better than that in the somewhat similar major POTR/CARO c.t. This in part may be attributable to less depletion caused by past grazing. Average air-dry production was 673 lb/acre (755 kg/ha), which still is below the mid-range of all aspen stands. An average 51 percent of this undergrowth was forbs, 34 percent shrubs, and only 15 percent graminoids. The suitability of the undergrowth as livestock forage appears to be about average for aspen communities, with 51 percent rated as desirable and 44 percent as intermediate. Thus, the potential of the type is below average as livestock summer range but slightly better for sheep than for cattle because of the higher proportion of forbs and shrubs than of graminoids. Value of the type as wildlife habitat is only moderate because of the modest amount of structural diversity in the vegetation.

Other—Communities of this general composition were recognized in the Utah aspen classification (Mueggler and Campbell 1986), but they were considered simply a southern extension of, and included in, the *P. tremuloides / S. oreophilus / Carex geyeri* c.t. of that publication. Subsequent observations in Nevada and a reevaluation of the Utah data indicate that these communities are indeed distinct.

Populus tremuloides/Symphoricarpos oreophilus/Wyethia amplexicaulis Community Type (POTR/SYOR/WYAM c.t.)

Distribution—The POTR/SYOR/WYAM c.t. was encountered only on the Humboldt National Forest in northeastern Nevada. This infrequent type was observed at elevations between 6,600 and 7,000 ft (2,000 and 2,100 m) on the Independence, Jarbidge, and East Humboldt mountain ranges. All these stands occupied relatively gentle 10 to 25 percent slopes of concave configuration. The type grew on soils derived from either quartzite or granitic parent rock.

Vegetation—The POTR/SYOR/WYAM c.t. and the more common POTR/WYAM c.t. are the only two aspen types recognized in the Intermountain Region in which the robust forb *Wyethia amplexicaulis* is a prominent part of the undergrowth. The two types are separated by the relative abundance of shrubs in the former. These shrubs contribute appreciably to the structural diversity of the type. *Symphoricarpos oreophilus* is generally the most abundant shrub, but *Amelanchier alnifolia* and *Ribes cereum* are frequently present. The herbaceous stratum usually is a greater assemblage of forbs and grasses than in the POTR/WYAM c.t. A mixture of low forbs, tall forbs, and grasses accompany the usually dominant *W. amplexicaulis*. The most commonly associated low forbs are *Geranium viscosissimum* and *Osmorhiza chilensis*. Such tall forbs as *Senecio serra*, *Hackelia floribunda*, and *Agastache urticifolia* are frequently present. The most common grasses are *Bromus carinatus* and *Agropyron trachycaulum*. Annual forbs, especially *Nemophila breviflora* and *Galium bifolium* are often abundant. Conifers were seldom encountered in the tree layer.

Succession—No evidence exists that the overstory of this type will be dominated by conifers. The undergrowth, however, is variable and subject to considerable change with grazing. The proportion of shrubs, tall forbs, and graminoids will tend to decrease under abusive livestock use, whereas *W. amplexicaulis*, other relatively unpalatable forbs, and annuals will increase in abundance. A direct negative relationship exists between the abundance of shrubs and abundance of *W. amplexicaulis*. If shrubs are abundant, ground-level shading is probably too intense to support vigorous *W. amplexicaulis*.

Production—None of the stands within the POTR/SYOR/WYAM c.t. were sampled for production. Judging from appearances, though, the type is more productive of trees than the somewhat similar POTR/WYAM c.t. in which aspen does not do well. The potential for wood fiber production is probably within the lower third percentile for all stands within the Region, with total basal area between 115 and 125 ft^2/acre (26.4 and 28.7 m^2/ha), aspen site index about 40 to 45 ft (12.2 to 13.7 m), and aspen volume production about 30 ft^3/acre/year (2.1 m^3/ha/year). The production of undergrowth is probably in the upper third percentile of all stands, or about 1,200 lb/acre (1,350 kg/ha). The proportion of this palatable to livestock is probably considerably higher than in the POTR/WYAM c.t. because a smaller proportion consists of the unpalatable *W. amplexicaulis* and a greater proportion in palatable shrubs, such as *S. oreophilus*, and in palatable forbs and graminoids. Wildlife habitat values are no better than moderate.

Other—The combination of *W. amplexicaulis* and *S. oreophilus* as undergrowth in aspen communities has not been reported previously, either within the Intermountain Region or elsewhere. *Wyethia amplexicaulis* is usually less dense and more dispersed in this type, where it is associated with *S. oreophilus*, than in the POTR/WYAM c.t.

Populus tremuloides/Astragalus miser Community Type (POTR/ASMI c.t.)

Distribution—This incidental type is fairly widespread. It occurs on the Gros Ventre Range in western Wyoming, in the Uinta Mountains of northern Utah, and on the Fishlake, Sevier, and Aquarius Plateaus of southern Utah. The type was not seen in either Idaho or Nevada. It occurs at elevations around 7,500 ft (2,300 m) in the northern part of the Region and about 8,700 to 9,900 ft (2,650 to 3,020 m) in southern Utah. The type generally occupied moderate slopes, those below 30 percent steepness, and did not appear restricted by exposure or soil parent material.

Vegetation—This is a structurally simple type that consists essentially of only two strata: an overstory tree layer of *Populus tremuloides* and an undergrowth stratum comprised principally of low-growing forbs (fig. 32). Also, the undergrowth generally has low species diversity. The

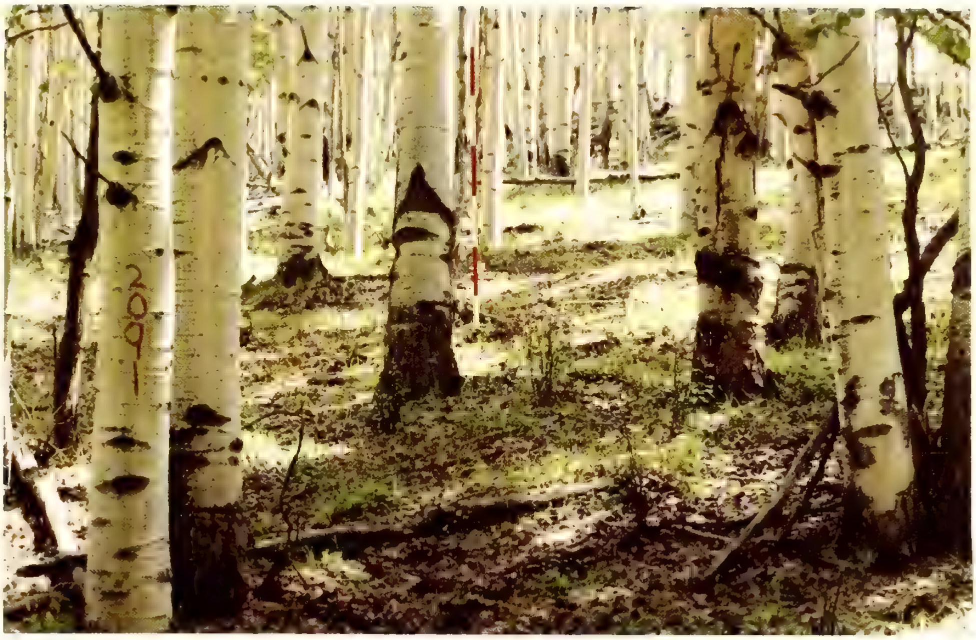

Figure 32—The *Populus tremuloides/Astragalus miser* c.t. is not encountered often, but is widespread in the Intermountain Region. The undergrowth, greatly affected by intense livestock grazing and characterized by an abundance of the low-growing forb *A. miser*, has low productivity and species diversity.

herbaceous undergrowth is characterized by an abundance of *Astragalus miser,* sometimes accompanied by considerable amounts of *Lupinus argenteus*. Other forbs frequently present are *Achillea millefolium* and *Taraxacum officinale*. A variety of graminoids may be encountered, but they are seldom abundant. The most common are *Bromus ciliatus*, *Agropyron trachycaulum*, and *Carex rossii*. Shrubs also may sometimes be present but are never abundant enough to form a distinct stratum. The most commonly encountered shrubs are *Rosa woodsii*, *Juniperus communis*, and *Symphoricarpos oreophilus*. Annual plants are usually scarce. Conifers such as *Abies lasiocarpa* or *Picea engelmannii* may be present in minor amounts in the tree stratum.

Succession—The POTR/ASMI c.t. is believed to be a grazing-induced type, judging from the amount of *A. miser*, *T. officinale*, and *A. millefolium* in the undergrowth and the general lack of palatable forbs and graminoids. Site similarities suggest it may be a grazing-degraded version of a POTR/CARU, POTR/CARO, POTR/SYOR/CARU, or POTR/SYOR/CARO c.t. Some of the stands within this type, where invasions by conifers appear to be occurring, may eventually succeed to an *A. lasiocarpa*-dominated forest.

Production—Total basal area production in the POTR/ASMI c.t. averages in the upper third percentile of all stands at 148 ft^2/acre (34.0 m^2/ha), but the suitability for the growth of aspen appears to be considerably below average. For the three stands sampled for production, aspen site index at 80 years averaged only 39 ft (11.8 m), and projected volume growth at stand maturity averaged only 24 ft^3/acre/year (1.7 m^3/ha/year). These values were in the lower quarter of all stands. Aspen reproduction was moderately good at 670 suckers/acre (1,656/ha), as was tree density at 915 stems/acre (2,261/ha). The type thus appears to have a below-average potential for the production of wood fiber.

Total production of undergrowth was poor, averaging only 395 lb/acre (443 kg/ha), which was in the lower quarter percentile of all stands. Most of this undergrowth was forbs, 74 percent, with 15 percent graminoids, and 11 percent shrubs. The suitability of the undergrowth as livestock forage was also poor, with only 26 percent classified as desirable and 37 percent as intermediate. A high 37 percent was classified as least desirable; usually a large proportion of this is the unpalatable *A. miser*. The type thus appears to be poor summer range for livestock. The combination of poor forage and lack of structural diversity makes this type also relatively poor habitat for wildlife.

Other—In the Bridger-Teton National Forest classification of aspen communities (Youngblood and Mueggler 1981), the *P. tremuloides / A. miser* type name encompassed a broader range of composition than does the current POTR/ASMI c.t. On the other hand, many of the current POTR/ASMI communities were included as part of the *P. tremuloides / Juniperus communis / A. miser* and *P. tremuloides / Carex geyeri* types in the Utah classification (Mueggler and Campbell 1986). The minimum quantity of *J. communis* required in the Utah classification was 5 percent rather than the 10 percent break point now used. Thus, stands with between 5 and 10 percent *J. communis* are now placed in the POTR/ASMI c.t.

Populus tremuloides/Juniperus communis/Astragalus miser Community Type (POTR/JUCO/ASMI c.t.)

Distribution—This incidental community type appeared primarily on the north slope of the Uinta Mountains in northeastern Utah where it accounts for 4 percent of the aspen communities on the Ashley National Forest. One stand was on the Markagunt Plateau in southern Utah. The type was not seen in either Wyoming, Idaho, or Nevada. Over three-fourths of the stands were growing at elevations in excess of 8,000 ft (2,400 m), which is fairly high for aspen communities in northern Utah. These stands occurred primarily on gentle slopes and on soils derived from sedimentary parent rock.

Vegetation—This type is both structurally and compositionally more complex than the related POTR/ASMI c.t., primarily because of the greater amount of shrubs. The type is characterized by a *Populus tremuloides* overstory underlain by a shrub stratum dominated by *Juniperus communis*, and an herb stratum in which *Astragalus miser* is either the dominant or a readily apparent forb. A wide variety of conifers may be encountered in the tree stratum or as reproduction, but they are not yet prominent. These include *Abies lasiocarpa*, *Pinus contorta*, *Pseudotsuga menziesii*, and even *Pinus ponderosa*. Besides the dominant *J. communis* in the shrub stratum, other common members of this layer are *Symphoricarpos oreophilus*, *Berberis repens*, *Rosa woodsii*, and minor amounts of *Artemisia tridentata*. In addition to *A. miser* in the herb layer, *Achillea millefolium, Taraxacum officinale*, *Geranium viscosissimum*, and *Thalictrum fendleri* are common. The most frequently encountered grasses are *Agropyron trachycaulum*, *Stipa occidentalis*, and *Leucopoa kingii*. Annuals are usually scarce.

Succession—As with the POTR/ASMI c.t., this type is also grazing induced because of the usual abundance of herbs that are either low in palatability or highly resistant to grazing, such as *A. miser*, *A. millefolium*, and *T. officinale*. The type may be a grazing-induced version of a POTR/JUCO/CAGE c.t. with which it bears considerable similarity except for the amount of *Carex geyeri*. The presence of conifers in many of the stands suggests that some stands could eventually become dominated by an overstory of either *P. menziesii* or possibly *A. lasiocarpa*. Composition and location similarities suggest that some stands within this type in the the Uinta Mountains are probably seral stages within the *P. menziesii/ Berberis repens* habitat type, *C. geyeri* phase. Most of the stands, however, will probably remain dominated by an aspen overstory.

Production—The wood-producing potential is about the same as the somewhat similar POTR/ASMI c.t. Three stands were sampled for production. Total stand basal area averaged 152 ft^2/acre (35.0 m^2/ha), which was in the mid-range of all aspen stands. Average site index for aspen at 80 years, 40 ft (12.1 m), and projected volume production at stand maturity, 25 ft^3/acre/year (1.8 m^3/ha/year), were in the lowest quarter of all stands. Both tree density at 739 stems/acre (1,826/ha) and aspen reproduction at 442 suckers/acre (1,094/ha) were about average. The type, therefore, does not appear to be good for growing trees.

Undergrowth production was even less than in the poorly rated POTR/ASMI c.t. It averaged only 290 lb/acre (325 kg/ha) of air-dry material. Of this, 64 percent was forbs, 25 percent graminoids, and 11 percent shrubs. The overall ranking of the undergrowth as forage was poor, with only 27 percent of the cover classified as desirable and 48 percent as intermediate. The combination of low undergrowth production and low forage suitability renders the type poor summer range for livestock. For similar reasons, plus limited structural diversity, the type probably provides relatively poor habitat for wildlife.

Other—Communities of this structure and composition were identified by the same name in the Utah classification (Mueggler and Campbell 1986), but the minimum cover requirements for *J. communis* were 5 percent rather than the 10 percent used here. Consequently, the POTR/JUCO/ASMI c.t. in the Utah classification included many of the stands now contained in the POTR/ASMI c.t. Although aspen communities with a low shrub component dominated by *J. communis* have been reported to occur in southeastern Wyoming (Alexander and others 1986), *A. miser* is not a prominent part of the herbaceous cover.

Populus tremuloides/Juniperus communis/Lupinus argenteus Community Type (POTR/JUCO/LUAR c.t.)

Distribution—This incidental community type has wide latitudinal distribution but is most frequent in the Uinta Mountains of northeastern Utah where it accounts for 5 percent of the aspen communities. Another cluster of stands was encountered on the Fishlake Plateau in southern Utah where it was 4 percent of the aspen communities on the Fishlake National Forest. The most northern stand was in the Wind River Mountains of eastern Wyoming. The type was not seen in either Nevada or Idaho. This is a fairly high elevation type. Over 90 percent of the stands were observed at elevations exceeding 8,000 ft (2,400 m). Over three-fourths of the stands were on north-facing or east-facing slopes and did not appear to be restricted by soil parent rock.

Vegetation—The vegetation of this type is similar to that of the POTR/JUCO/ASMI c.t. except for the prevalence of *Lupinus* spp. rather than *Astragalus miser* in the herbaceous layer. Stands consist of a tree layer dominated by *Populus tremuloides* with an occasional conifer, a shrub layer in which *Juniperus communis* is prominent, and usually a rather sparse herbaceous layer in which *Lupinus argenteus* is prominent. *Symphoricarpos oreophilus* and *Berberis repens* are frequently associated with *J. communis* in the shrub stratum. Forbs commonly associated with *Lupinus* spp. are *Antennaria microphylla, Thalictrum fendleri*, and *Taraxacum officinale.* No single graminoid is typical of the type. However, *Stipa occidentalis* and *Agropyron trachycaulum* are frequent, and occasionally *Bromus anomalus* or *Poa fendleriana* may be abundant. Annuals are usually scarce.

Succession—This community type represents a stable aspen situation, judging from the general lack of conifers in the stands examined. The undergrowth is fairly depauperate and may be the result of heavy past use by livestock. The similarity of the type to the POTR/JUCO/ASMI c.t. suggests that it may have derived from similar communities, such as the POTR/JUCO/CAGE c.t. Additional abusive grazing can only lead to further reduction of desirable forage species and a further increase of such species as *T. officinale*, *A. microphylla*, and perhaps *L. argenteus*.

Production—Production was evaluated on the basis of a single stand. Although tree basal area was considerably above average for aspen communities at 193 ft^2/acre (44.3 m^2/ha), the growth rate of aspen was in the lower third percentile of all stands. Site index at 80 years was only 44 ft (13.5 m), and estimated volume production only 32 ft^3/acre/year (2.2 m^3/ha/year). Tree density was low at 400 stems/acre (988/ha).

Annual production of undergrowth, however, was a moderate 766 lb/acre (859 kg/ha). Of this, 40 percent consisted of graminoids, 35 percent shrubs, and 25 percent forbs. This undergrowth was of intermediate suitability as livestock forage, with 41 percent classified as desirable and 46 percent as intermediate. The type is therefore moderately productive summer range for livestock. The value as wildlife habitat is limited because of the lack of good hiding cover.

Other—Communities now within this type were formerly absorbed as parts of the *P. tremuloides / J. communis / Sitanion hysterix* and *P. tremuloides / J. communis / Carex geyeri* c.t.'s in the Utah classification (Mueggler and Campbell 1986). They are now regarded as sufficiently distinct to merit a separate category.

Populus tremuloides/Stipa comata Community Type (POTR/STCO c.t.)

Distribution—The POTR/STCO c.t. is an infrequent but widely distributed type encountered as far north in the Region as the Centennial Mountains on the Targhee National Forest in Idaho and as far south as the Markagunt Plateau in southern Utah. It is most common on the Dixie Forest in southern Utah where it accounts for 7 percent of the aspen communities. It was also observed on the Fishlake, Ashley, and Wasatch-Cache National Forests. It was not seen in Nevada. The broad latitudinal distribution of this type accounts for a wide elevational range, from about 6,500 ft (2,300 m) at its northern extreme to between 8,500 and 9,500 ft (2,600 and 2,900 m) at the southern extreme on the Dixie National Forest. All stands sampled occupied gentle slopes and did not appear restricted by exposure. The soils were primarily derived from igneous parent rock, but a few stands were on sandstones.

Vegetation—The vegetation of this incidental type consists of only two strata and reflects the comparatively dry environment in which it occurs. The tree layer is almost exclusively *Populus tremuloides* with, in some cases, minor amounts of conifers. The undergrowth may contain minor amounts of such shrubs as *Juniperus communis*, *Artemisia tridentata*, *Berberis repens*, and even *Symphoricarpos oreophilus*, but not enough to form a distinct stratum. The herbaceous undergrowth is usually a rather depauperate mixture of grasses and forbs. The undergrowth is characterized by the prominence of one or more of the following grasses: *Stipa comata, Sitanion hystrix,* or *Festuca idahoensis.* Occasionally, *Poa fendleriana* may be abundant. The forb species most commonly found are *Taraxacum officinale, Lupinus argenteus, Antennaria microphylla*, and *Astragalus miser*. Annual species are usually scarce.

Succession—This generally appears to be a stable aspen type restricted to relatively dry sites. Where *Pinus ponderosa* is actively invading, the type will eventually succeed to a *P. tremuloides-P. ponderosa* cover type and eventually to a climax type within the *P. ponderosa* coniferous forest series. The abundance of *S. hystrix* and *T. officinale* suggests that the undergrowth has been appreciably degraded by prolonged and heavy livestock grazing. *Poa fendleriana, Bromus ciliatus,* and possibly *S. oreophilus* were likely more abundant in many of these stands prior to the advent of domestic livestock. Continued abusive grazing would favor an even greater abundance of such low-palatability species as *S. hystrix* and *A. microphylla* and a loss of species that are more palatable to sheep and cattle.

Production—Six stands were sampled in the POTR/STCO c.t. to obtain an estimate of productivity. Both tree density at 586 stems/acre (1,445/ha) and stand basal area at 152 ft^2/acre (34.8 m^2/ha) were in the middle third of all aspen stands. Factors indicative of the growth rate of aspen, however, ranked in the lower third of all stands. Aspen site index averaged only 43 ft (13.1 m), and estimated volume production of aspen at stand maturity averaged only 30 ft^3acre/year (2.1 m^3/ha/year). Aspen reproduction was moderate at 1,070 suckers/acre (2,643/ha). Thus, the potential of the type for the production of wood fiber appeared to be below average for all aspen stands.

The production of undergrowth was poor. An average of only 460 lb/acre (516 kg/ha) of air-dry herbage was produced, which ranks the type in the lower quarter of all stands. This was divided about equally between graminoids at 53 percent and forbs at 45 percent, with only an average 2 percent of shrubs. This meager undergrowth, however, ranked fairly well as livestock forage, with 59 percent desirable and 38 percent intermediate. Despite the desirable quality of the undergrowth, the type ranks only fair as summer range for livestock because of the relatively small amount of forage produced. The type is poor habitat for wildlife because of poor structural diversity of the vegetation combined with low forage productivity.

Other—Aspen communities formerly identified in the Utah classification (Mueggler and Campbell 1986) as being in the *P. tremuloides / S. hysterix* c.t. are now in the POTR/STCO c.t.

Populus tremuloides/ *Shepherdia canadensis* Community Type (POTR/SHCA c.t.)

Distribution—The POTR/SHCA c.t. is a local, incidental type encountered only in eastern Idaho and western Wyoming. Greatest concentration was in the vicinity of the Gros Ventre Range where it accounts for 4 percent of the aspen communities on the Bridger-Teton National Forest. The type also was observed along the Webster Range on the Caribou National Forest and in the Centennial Mountains of the Targhee National Forest. Most of the stands grew at elevations between 7,000 and 8,000 ft (2,100 and 2,400 m), which is moderately high for aspen communities at the latitude of eastern Idaho and adjacent Wyoming. These stands usually occupied the mid to low positions on fairly steep slopes. Soil parent materials did not appear to be limiting.

Vegetation—The POTR/SHCA c.t. is distinguished by the prominence of *Shepherdia canadensis* in a shrub stratum below the predominantly *Populus tremuloides* overstory. Conifers, especially *Abies lasiocarpa* and *Picea engelmannii*, are frequently present in small amounts, usually as reproduction. In addition to *S. canadensis*, the shrub stratum commonly contains appreciable amounts of *Rosa woodsii* and *Symphoricarpos oreophilus*. Occasionally, *Pachystima myrsinites* is also abundant. The herb layer is a composite of graminoids and forbs, with the latter usually the most abundant. The most common and usually most abundant forbs are *Geranium viscosissimum*, *Lupinus argenteus*, *Thalictrum fendleri*, *Osmorhiza chilensis*, and *Fragaria vesca*. A wide variety of graminoids may be found, no one of which appears typical. The most common are *Agropyron trachycaulum* and *Bromus ciliatus*. Sometimes *Calamagrostis rubescens* can be abundant. Annuals are usually scarce.

Succession—The majority of stands were successional to a *P. tremuloides—A. lasiocarpa / S. canadensis* c.t., which eventually should succeed to conifer dominance within the *A. lasiocarpa* forest climax series. It is most likely a seral community within the *S. canadensis* phase of the *A. lasiocarpa / Arnica cordifolia* habitat type described by Steele and others (1983). The rate of this successional sequence depends, of course, on the rapidity of conifer establishment in the stands and the lack of any further disturbance that would destroy this regeneration.

Production—Only a single stand was sampled for production. The stand basal area was 136 ft^2/acre (31.2 m^2/ha), aspen site index was 49 ft (14.9 m), and estimated volume production was 38 ft^3/acre/year (2.6 m^3/ha/year). All of these measurements of tree productivity ranked in the mid-third percentile of all aspen stands.

Production of undergrowth also ranked in the mid-third percentile at 1,035 lb/acre (1,161 kg/ha). Of this, 45 percent consisted of forbs, 35 percent graminoids, and 20 percent shrubs. The quality of the undergrowth as livestock forage was reasonably good, with 48 percent desirable and 46 percent intermediate. From this limited sample, the POTR/SHCA c.t. appears to be moderately good summer range for livestock as well as fairly good habitat for wildlife.

Other—Communities of this composition were identified in the Bridger-Teton National Forest classification (Youngblood and Mueggler 1981) with the same name. In addition, some of the stands placed in the *P. tremuloides / Juniperus communis* c.t. in that classification are now included in the POTR/SHCA c.t. Aspen communities with *S. canadensis* as a major shrub have not been reported to occur outside of the Intermountain Region.

Populus tremuloides—Abies lasiocarpa/*Shepherdia canadensis* Community Type (POTR-ABLA/SHCA c.t.)

Distribution—The POTR-ABLA/SHCA c.t. is a relatively local type confined to an area similar to that of the POTR/SHCA c.t. The type is concentrated on the Gros Ventre and Wyoming Ranges of western Wyoming where it accounts for 5 percent of the aspen communities on the Bridger-Teton National Forest. It was also observed along the Bear River Range in eastern Idaho and northern Utah. This type was not seen in central or southern Utah or in Nevada. The type was at moderately high elevations for this latitude, ranging from 7,000 to 8,300 ft (2,100 to 2,500 m). The 11 stands sampled generally occupied moderately steep slopes that had northerly or easterly exposures.

Vegetation—The vegetation is fairly complex structurally, consisting of a tree layer dominated by *Populus tremuloides*, but with substantial amounts of conifers, a shrub stratum, and a mixed grass and forb herb stratum. *Abies lasiocarpa* or *Picea engelmannii* are always prominent in the tree stratum or as reproduction. *Pinus contorta* and *P. flexilis* may also be present in varying amounts. *Shepherdia canadensis*, always prominent member in the shrub layer, is frequently accompanied by sometimes considerable amounts of *Pachystima myrsinites*, *Symphoricarpos oreophilus*, *Rosa woodsii*, or *Berberis repens*. The herbaceous undergrowth is usually dominated by forbs, although a variety of graminoids may be present, particularly *Elymus glaucus*. The most common and abundant herbs usually are *Thalictrum fendleri*, *Osmorhiza chilensis*, *Arnica cordifolia*, *Epilobium angustifolium*, and *Lupinus* spp. The type seldom has many annual species.

Succession—This community type is closely related to the POTR/SHCA c.t. and is a later stage in succession that will eventually lead to an *A. lasiocarpa* climax forest. The presence of either *A. lasiocarpa* or *P. engelmannii* as codominants with *P. tremuloides* in the overstory, or as substantial reproduction, is the principal difference between this and the POTR/SHCA c.t. As succession proceeds from a POTR/SHCA c.t. to a POTR-ABLA/SHCA c.t., such species as *R. woodsii, Bromus ciliatus, E. angustifolium, Fragaria vesca, G. viscosissimum*, and *Lupinus* spp. tend to decrease in abundance. The type probably represents a successional stage within the *A. lasiocarpa/Arnica cordifolia* habitat type, *S. canadensis* phase (Steele and others 1983).

Production—The production data base consists of a single stand in which the undergrowth was overwhelmingly dominated by the shrub *S. canadensis*. Undergrowth production, 1,114 lb/acre (1,249 kg/ha), was in the upper third percentile of all aspen stands. The stand is somewhat unusual in that 90 percent of the undergrowth was shrubs, with only 9 percent forbs and 1 percent graminoids. Overall tree basal area was above average at 170 ft^2/acre (39.1 m^2/ha), but aspen growth factors were in the lower third percentile of all stands. Aspen site index at 80 years was only 43 ft (13.2 m), and volume production at stand maturity was only 30 ft^3/acre/year (2.1 m^3/ha/year). This stand was being actively invaded by *A. lasiocarpa*, with over 4,500 established seedlings growing per acre (11,000/ha). Based on this single stand, the type appears to be only fair for the production of wood fiber and rather poor range for livestock. On the other hand, it is believed to provide relatively good habitat for wildlife.

Other—These communities were identified previously in the Bridger-Teton National Forest classification (Youngblood and Mueggler 1981) under the same name. In addition, some of the communities classified as in the *P. tremuloides—A. lasiocarpa / B. repens* c.t. in that classification are now included in the POTR-ABLA/SHCA c.t.

Populus tremuloides—Abies lasiocarpa/Amelanchier alnifolia Community Type (POTR-ABLA/AMAL c.t.)

Distribution—This infrequent but widely distributed community type was observed as far north as the Snake River Range on the Caribou National Forest in eastern Idaho and as far south as the Abajo Mountains in southeastern Utah. Greatest concentration was along the Bear River and Wasatch Ranges of northern Utah. It was not observed in Nevada. The type occurred at the lower edge of the *Abies lasiocarpa* zone. Stands in the northern part of the Region were at elevations between 5,800 and 7,800 ft (1,770 and 2,400 m), whereas those in the Abajo Mountains were at about 8,500 ft (2,600 m). The type occupied primarily moderate to steep slopes with a northerly aspect. Soil parent rock did not appear to be limiting.

Vegetation—The POTR-ABLA/AMAL c.t. contains considerable structural and species diversity. The vegetation has four more or less distinct layers. The tree overstory is dominated by *Populus tremuloides* but has a substantial amount of *Abies lasiocarpa* or *Picea engelmannii* that may be accompanied by other conifers as well. The tall shrub layer is typified by the presence of *Amelanchier alnifolia, Prunus virginiana*, or *Acer grandidentatum*. A pronounced low shrub layer exists that usually has *Symphoricarpos oreophilus* as its most abundant constituent. Other frequently abundant shrubs include *Rosa woodsii*, *Berberis repens*, and *Pachystima myrsinites*. The herbaceous layer usually contains a fairly rich mixture of tall forbs, low forbs, and graminoids, no single species of which is present in great abundance. The most common tall forbs in the type are *Senecio serra, Aster engelmannii, Hackelia floribunda*, and *Agastache urticifolia*. Among the low forbs, *Thalictrum fendleri, Osmorhiza chilensis*, and *Stellaria jamesiana* are most frequent. In some stands, *Lathyrus* spp. provide considerable ground cover. A wide variety of graminoids occur in this type, but only *Elymus glaucus* had high constancy. Annual plants are seldom abundant.

Succession—The type obviously represents a seral stage within the *A. lasiocarpa* coniferous forest series. The natural process of succession will lead to overstory dominance by *A. lasiocarpa*. Judging from comparisons of species constancies (appendix E), the type represents a seral stage within either the *A. lasiocarpa / B. repens* or *A. lasiocarpa / O. chilensis* habitat types (Mauk and Henderson 1984), most likely the former. As conifers become more prevalent, the shrubby and herbaceous undergrowth tends to become less abundant, less diverse, and shifts in composition toward the more shade-tolerant species. Heavy grazing tends to suppress the *S. oreophilus* and *A. engelmannii*, and to favor *P. myrsinites* and *B. repens*. If grazed by cattle, composition would additionally tend to shift away from the grasses and toward a greater abundance of *T. fendleri* and *O. chilensis*. Heavy sheep grazing would tend to favor the grasses at the expense of the more palatable forbs and shrubs.

Production—Productivity for trees is in the mid-range of all aspen stands, judging from the five stands in the type sampled. Total basal area averaged 146 ft^2/acre (33.5 m^2/ha), 87 percent of which was aspen. Site index for aspen at 80 years was 53 ft (16.2 m), and estimated volume growth at stand maturity was 43 ft^3/acre/year (3.0 m^3/ha/year). Aspen reproduction was fairly high, averaging 2,119 suckers/acre (5,236/ha), but conifers were becoming established with 145 seedlings/acre (358/ha). The density of aspen trees averaged 562 stems/acre (1,388/ha).

Undergrowth productivity was also in the upper third percentile of all aspen stands, averaging 1,162 lb/acre (1,303 kg/ha). This undergrowth was primarily forbs, an average 44 percent, and shrubs, 42 percent, with graminoids the remaining 14 percent. The composition of this undergrowth was in the mid-range of forage suitability, with 52 percent rated as desirable and 40 percent as intermediate. The type is therefore good livestock range, particularly for sheep, if succession has not progressed to the point where conifers are appreciably suppressing the production of shrubs and herbs. The type is excellent wildlife habitat because of the large amount of structural diversity: an overstory consisting of both aspen and conifers, a tall shrub layer, a low shrub layer, and an herb layer of forbs and grasses.

Other—These communities were classified under the same name in the Utah aspen classification (Mueggler and Campbell 1986) but were given the name *P. tremuloides—A. lasiocarpa / P. virginiana* c.t. in the Bridger-Teton National Forest classification.

Populus tremuloides—Abies lasiocarpa/Symphoricarpos oreophilus/ Bromus carinatus Community Type (POTR-ABLA/SYOR/BRCA c.t.)

Distribution—This infrequent seral type is widely distributed in Utah and occurs at least as far north as the Bear River Range and as far south as the Markagunt Plateau. The type was not seen in either Wyoming, Idaho, or Nevada. This is a moderate elevation type, usually growing between 8,000 and 9,000 ft (2,400 and 2,700 m) on gentle to moderately steep slopes, irrespective of aspect.

Vegetation—The type essentially has three strata: a predominantly *Populus tremuloides* tree layer that contains substantial amounts of *Abies lasiocarpa* and sometimes other conifers, a low shrub stratum consisting of *Symphoricarpos oreophilus* and frequently *Rosa woodsii,* and an herbaceous stratum that is heavy toward grasses and light on those forbs that serve as indicators of other types. The herbaceous undergrowth is generally sparse. The characterizing grasses, *Bromus carinatus*, *Agropyron trachycaulum*, and *Elymus glaucus*, are individually or collectively readily apparent and often prominent. Occasionally, *Carex geyeri* or *Poa pratensis* may be abundant. Although a variety of forbs often occurs in this type, seldom will one species provide much ground cover. The exception are *Lathyrus* spp., which frequently are abundant. The other forbs that occur most frequently but in minor quantities are *Achillea millefolium*, *Thalictrum fendleri*, *Geranium viscosissimum*, and *Osmorhiza chilensis*. Annuals usually are common.

Succession—This is a minor seral community type that reflects the effect of both succession to conifers and heavy past grazing. The frequent presence of minor amounts of members of the tall forb group of species, particularly *Senecio serra*, *Rudbeckia occidentalis*, *Hackelia floribunda*, *Aster engelmannii*, and *Agastache urticifolia*, suggests that this type is a grazing-altered version of the major POTR-ABLA/SYOR/TALL FORB c.t., which in turn represents a seral stage in the *A. lasiocarpa* coniferous forest climax series. The type probably occurs within the *A. lasiocarpa / O. chilensis* habitat type described by Mauk and Henderson (1984). Heavy, prolonged grazing by sheep has likely permitted the grasses and less palatable forbs to increase at the expense of the palatable forbs. Under the normal course of succession, the amount and diversity of this herbaceous undergrowth will diminish as the conifers increasingly dominate the tree layer.

Production—The single stand sampled for production fell within the mid-third percentile of all stands in production of aspen but in the lower quarter of all stands in the production of undergrowth. Aspen site index was 45 ft (13.7 m), potential volume production was 33 ft^3/acre/year (2.3 m^3/ha/year), and tree density was 1,134 stems/acre (2,802/ha). Total basal area was 106 ft^2/acre (24.3 m^2/ha), 8 percent of which was conifers.

The stand produced only 544 lb/acre (610 kg/ha) of undergrowth, which was of moderate value as livestock forage. This measurement is probably somewhat low and not truly represenative of the type, which generally appears more productive. In any event, the type provides good habitat for wildlife because of the fairly high amount of structural diversity.

Other—This type was not recognized as a separate entity in the earlier classifications within the Region.

Populus tremuloides—Abies lasiocarpa/Symphoricarpos oreophilus/ Thalictrum fendleri Community Type (POTR-ABLA/SYOR/THFE c.t.)

Distribution—This infrequent type is widely distributed across the Region. It occurred on nine of the 11 National Forests within the study area. The exceptions were the Targhee in Idaho and the Toiyabe in Nevada. The type was most common along the Bear River Range in Idaho and northern Utah, but even there it was scarce. The type generally was at midelevations between 7,000 and 7,500 ft (2,100 and 2,300 m) in southeastern Idaho and between 8,000 and 9,000 ft (2,400 and 2,700 m) in southern Utah. It occupied primarily mid-slope positions of moderately steep slopes with northeasterly exposures. Soil parent materials did not appear to be restrictive.

Vegetation—The vegetation of this minor seral community type was sampled on the basis of 15 stands. The overstory, although still dominated by *Populus tremuloides*, has prominent amounts of *Abies lasiocarpa* or *Picea engelmannii* either in the tree canopy or as reproduction. Other conifers that may be present in substantial amounts include *Pinus contorta* and *Pseudotsuga menziesii*. Low shrubs are usually fairly abundant. The most common and abundant are *Symphoricarpos oreophilus*, *Berberis repens*, *Rosa woodsii*, and *Pachystima myrsinites*. The herbaceous undergrowth consists of a mixture of forbs and graminoids but is characterized by the prominence of *Thalictrum fendleri*, *Osmorhiza chilensis*, or *Geranium viscosissimum*. Other forbs that sometimes occur in considerable abundance are *Lupinus argenteus*, *Arnica cordifolia*, and *Fragaria vesca*. A wide variety of graminoids may be observed, but none appears to characterize all stands. The most frequently encountered are *Elymus glaucus*, *Bromus carinatus*, *Carex geyeri*, and *Carex rossii*, none of which occurred in more than half the stands. Annual plants are usually scarce.

Succession—The amounts and species of conifers indicate that the type will eventually succeed to the *A. lasiocarpa* coniferous forest climax series. Comparisons of species composition suggest that this probably is a seral stage within possibly both the *A. lasiocarpa / B. repens* and *A. lasiocarpa / O. chilensis* habitat types (Mauk and Henderson 1984; Youngblood and Mauk 1985). As in other such seral types, this successional process is usually accompanied by a reduction in the amount and diversity of undergrowth cover as light intensity at the forest floor decreases with increased amounts of conifers in the tree canopy.

Production—The four stands sampled for productivity averaged 192 ft^2/acre (44.2 m^2/ha) of stand basal area, which was in the upper quarter of all aspen stands; 80 percent of this consisted of aspen. However, the potential of the type for aspen growth appears about average for all stands. Site index at 80 years averaged 48 ft (14.5 m), and estimated volume production at stand maturity averaged 36 ft^3/acre/year (2.5 m^3/ha/year). Average tree density was good at 983 stems/acre (2,429/ha). Aspen reproduction averaged a moderate 790 suckers/acre (1,951/ha). Eventual replacement of the aspen by conifers was evidenced by the presence of an average 402 established *A. lasiocarpa* seedlings/acre (993/ha). The type thus appears to have at least a moderate potential for the production of wood fiber.

Annual production of undergrowth averaged a moderate 757 lb/acre (849 kg/ha). The bulk of this usually was forbs, an average 81 percent, with 14 percent shrubs and only 5 percent graminoids. The suitability of the undergrowth as livestock forage was good; 60 percent was classified as desirable. The type is at least moderately productive summer range for livestock, particularly for sheep, because of the abundance of forbs. It also is fairly good wildlife habitat because of the diversity of the vegetation in both the tree stratum and in the undergrowth.

Other—Communities with this structure and composition were not treated as a separate type in the previous classifications. However, they were a major part of the *P. tremuloides—A. lasiocarpa / S. oreophilus / C. geyeri* c.t. in the Utah classification (Mueggler and Campbell 1986). These communities were also included in the more general *P. tremuloides—A. lasiocarpa / S. oreophilus* c.t. of the Caribou and Targhee National Forests classification (Mueggler and Campbell 1982) and in the *P. tremuloides—A. lasiocarpa / B. repens* c.t. of the Bridger-Teton National Forest classification (Youngblood and Mueggler 1981).

Populus tremuloides—Abies lasiocarpa/Juniperus communis Community Type (POTR-ABLA/JUCO c.t.)

Distribution—The POTR-ABLA/JUCO c.t. is an incidental type seldom seen except on the high plateaus of southern Utah where it accounts for 6 percent of the aspen communities on both the Dixie and Fishlake National Forests. The type also occurred in the Uinta Mountains of northeastern Utah and in the Snake Range of eastern Nevada. It was not observed in either eastern Idaho or western Wyoming. This is a fairly high elevation type. All 19 of the stands sampled were between 8,000 and 10,000 ft (2,400 and 3,000 m). The type does not appear to be restricted by slope aspect or soil parent rock.

Vegetation—The vegetation is characterized by the prominence of a low shrub stratum dominated by *Juniperus communis* below a mixed aspen-conifer overstory in which *Abies lasiocarpa* or *Picea engelmannii* are prominent. Tall shrub species are generally lacking. Shrubs that frequently accompany *J. communis* in the low shrub layer are *Symphoricarpos oreophilus*, *Rosa woodsii*, and *Berberis repens*. The herbaceous stratum is usually sparse. The most commonly encountered graminoids are *Carex rossii*, *Bromus anomalus*, and *Stipa occidentalis*. The forb element usually consists of such low-growing species as *Achillea millefolium*, *Taraxacum officinale*, *Fragaria vesca*, and *Astragalus miser*. Few annual plants occur in this type.

Succession—The type obviously represents a seral stage within the *A. lasiocarpa* coniferous forest series, probably within the *A. lasiocarpa / J. communis* habitat type (Youngblood and Mauk 1985), judging from comparisons of species composition. As with other such aspen communities seral to coniferous forests, dominance by *Populus tremuloides* can only be maintained by such extreme disturbances as burning, clearcutting, or selective removal of the conifers to set back the successional process. Heavy livestock grazing within this type tends to change the herbaceous composition even more to favor the *A. miser*, *F. vesca*, and *T. officinale*. The abundance of the shrubby *J. communis* undergrowth would likely increase as well.

Production—Judgment of the productivity potential of the POTR-ABLA/JUCO c.t. is based upon a sample of one stand. Although the type appears at least moderately productive of wood fiber, production of undergrowth is poor. Total tree basal area in this one stand was 161 ft^2/acre (37.1 m^2/ha), almost three-fourths of which was aspen. Aspen growth potential was in the mid-third percentile of all stands with a site index of 56 ft (17.1 m) at 80 years and estimated volume production of 47 ft^3/acre/year (3.3 m^3/ha/year). Aspen reproduction was a low 232 suckers/acre (574/ha), whereas established reproduction of *A. lasiocarpa* and *P. engelmannii* was 168 seedlings/acre (415/ha). The stand produced only 258 lb/acre (298 kg/ha) of undergrowth, which is in the lowest 10 percent of all aspen stands. The bulk of this undergrowth was forbs at 62 percent, with 35 percent shrubs and only 3 percent graminoids. What little there was appeared to provide fairly good forage, with 51 percent classified as desirable and 48 percent as intermediate. The generally low quantity of forage limits the value of this type as livestock range. It is also of only moderate value as wildlife habitat because neither vegetation structure nor plant species diversity are great.

Other—Communities of this structure and composition were treated under the same type name in the Utah classification (Mueggler and Campbell 1986).

Populus tremuloides—Abies lasiocarpa/Carex geyeri Community Type (POTR-ABLA/CAGE c.t.)

Distribution—This incidental seral type is widely distributed from Idaho and Wyoming to southern Utah. It occurred on the Wyoming and Salt River Ranges in western Wyoming, the Portneuf Range in eastern Idaho, and from the Bear River Range in northern Utah southward to the Abajo Mountains in southeastern Utah. The type was not seen in Nevada. In the northern part of the Region it usually occurs at elevations between 6,000 and

7,500 ft (1,800 and 2,300 m) and at the southern extreme at elevations between 9,000 and 10,000 ft (2,700 and 3,000 m). The type was on gentle and moderately steep slopes and on soils derived from both igneous and sedimentary parent rock.

Vegetation—The prominence of either *Carex geyeri* or *Calamagrostis rubescens* (usually the former) in the herb stratum and the lack of a distinct shrub stratum characterize the undergrowth of this successional type. The tree layer is a variable mixture of *Populus tremuloides* and either *Abies lasiocarpa* or *Picea engelmannii* or both. Other conifers are often present as well, particularly *Pseudotsuga menziesii*. Although shrubs frequently occur in this type, no single characterizing species is prominent. Among the most common shrubs are *Symphoricarpos oreophilus*, *Rosa woodsii*,, and *Berberis repens*. In addition to the characterizing *C. geyeri* or *C. rubescens* in the herb layer, other grasses occasionally abundant are *Elymus glaucus* and *Bromus ciliatus*. This type usually has a more diverse mixture of forbs than either the POTR-ABLA/JUCO or POTR-ABLA/CARO types, but all of the forbs are fairly low in stature. The most common and usually most abundant of these are *Thalictrum fendleri*, *Achillea millefolium*, *Osmorhiza chilensis*, and *Taraxacum officinale*. Occasionally, *Astragalus miser*, *Geranium viscosissimum*, or *Lathyrus* spp. will be abundant. Annuals are not usually abundant.

Succession—The POTR-ABLA/CAGE c.t. is a seral stage within the *A. lasiocarpa* forest climax series. In the southern part of the Region, this occurs within the *A. lasiocarpa / C. geyeri* habitat type as described by Youngblood and Mauk (1985). In the northern part of the Region, this seral type appears most closely related compositionally to the *A. lasiocarpa / C. rubescens* habitat type (Mauk and Henderson 1984; Steele and others 1983), even though the similarity index comparisons are not high (appendix E). Heavy grazing will likely lead to impoverishment of the few palatable plants and favor an increase in dominance of such grazing-resistant species as *T. officinale*, *A. miser*, and *A. millefolium*.

Production—This incidental type is above average in the production of trees and below average in production of forage. Total tree basal area for the five stands sampled for production averaged a fairly high 169 ft^2/acre (38.9 m^2/ha). Conifers were 14 percent of this. Aspen growth was moderate, with a site index at 80 years averaging 46 ft (14.0 m) and estimated volume production of 34 ft^3/acre/year (2.4 m^3/ha/year). Aspen reproduction averaged a moderate 617 suckers/acre (692/ha), but conifers appeared to be vigorously invading. An average of over 3,800 established seedlings per acre (9,390/ha) of *A. lasiocarpa* occurred in these stands.

Only 617 lb/acre (692 kg/ha) of undergrowth was produced annually, which is in the lower third percentile of all stands. This generally consisted of a balanced mixture of forbs at 55 percent and graminoids at 43 percent, with only 2 percent shrubs. The POTR-ABLA/CAGE c.t. provides below-average summer range for livestock, primarily because of low forage productivity. As conifers increase in a stand, forage production becomes progressively less. Wildlife habitat values are usually low because the vegetation lacks diversity in both species composition and community structure.

Other—The POTR-ABLA/CAGE c.t. was identified by this name in the Utah aspen classification (Mueggler and Campbell 1986). Although this seral type has not been specifically identified as occurring outside of the Intermountain Region, similar seral communities can probably be found, at least in northwestern Colorado. Hoffman and Alexander (1980, 1983) identified an *A. lasiocarpa / C. geyeri* habitat type on the Routt and White River National Forests that has *P. tremuloides* as a major seral tree.

Populus tremuloides—Pinus contorta/ Symphoricarpos oreophilus Community Type (POTR-PICO/SYOR c.t.)

Distribution—This minor seral community type was observed only on National Forests in the northern part of the study area: the Targhee, Caribou, Wasatch-Cache, and Ashley. Greatest abundance was on the Caribou Range in southeastern Idaho and the Uinta Mountains of northeastern Utah. The type was not encountered on the northern Nevada forests. The POTR-PICO/SYOR c.t. appears to be adapted to a wide range of environments. It occurred at elevations ranging from 5,700 to 9,800 ft (1,700 to 3,000 m), and did not appear confined by slope, exposure, or soil parent materials.

Vegetation—This is one of four seral aspen types in which *Pinus contorta* is the only prominent conifer in the tree layer. The undergrowth is characterized by a low shrub stratum in which *Symphoricarpos* spp., *Rosa* spp., or *Pachystima myrsinites* are prominent. The tall-growing shrubs *Amelanchier alnifolia* or *Prunus virginiana* are frequently present and sometimes are abundant. The herbaceous stratum generally has a comparative abundance of the graminoids *Calamagrostis rubescens* or *Carex geyeri*. *Elymus glaucus* is often present. A variety of low-growing forbs have been observed in this type, the most frequent of which are *Thalictrum fendleri*, *Lupinus argenteus*, *Geranium viscosissimum*, *Osmorhiza chilensis*. *Achillea millefolium*, and *Fragaria vesca*. Although the undergrowth is usually not lush, it is often fairly diverse. Annuals are usually scarce.

Succession—This is a seral type in which succession is obviously away from dominance by *Populus tremuloides* and toward dominance by the more shade-tolerant conifers. *Populus tremuloides* is gradually being replaced by *P. contorta*. Many of the stands within this type will likely be dominated eventually by *Abies lasiocarpa*, judging by the reproduction of this conifer. This is probably a seral stage within the *A. lasiocarpa / O. chilensis* habitat types of the northern part of the Region (Mauk and Henderson 1984; Steele and others 1983). As the conifer cover increases, the amount and the diversity of undergrowth, especially of herbs, will decrease. Heavy grazing by cattle will likely result in a decrease in the amount of *C. rubescens*, *C. geyeri*, and *E. glaucus* and an increase of the grass *Poa pratensis* and many of the low-growing forbs. Heavy grazing by sheep will probably favor the graminoids to the detriment of many of the forbs and shrubs.

Production—The potential for the production of wood is slightly below the average for all aspen stands. Total tree basal area for the two stands sampled averaged 126 ft²/acre (29.0 m²/ha). Site index at 80 years for aspen was only 39 ft (11.7 m) and volume production only 24 ft³/acre/year (1.7 m³/ha/year). Both of these growth estimates were in the lower quartile of all stands. Aspen reproduction averaged a moderate 1,006 suckers/acre (2,484/ha), with tree density averaging 1,398 stems/acre (3,454/ha).

The production of undergrowth was a moderate 857 lb/acre (961 kg/ha). Of this, 54 percent was forbs, 31 percent shrubs, and only 15 percent graminoids. The suitability of the undergrowth as forage for livestock was considered good, with 60 percent classified as desirable and only 1 percent as least desirable. The type thus appears to provide at least moderately good summer range for livestock. It is probably more suitable for sheep than for cattle because of the relative abundance of forbs and shrubs. The type also provides fairly good habitat for wildlife because of the diversity of vegetation structure.

Other—Communities of this type were included in the Caribou and Targhee National Forests classification (Mueggler and Campbell 1982) as part of the *P. tremuloides—P. contorta / C. rubescens* c.t.

Populus tremuloides—Pinus contorta/ Thalictrum fendleri Community Type (POTR-PICO/THFE c.t.)

Distribution—This is a minor seral type with limited distribution. It was observed only on the north slope of the Uinta Mountains and on the east face of the Bear River Range of northern Utah. The seven stands sampled ranged in elevation from 7,100 to 8,900 ft (2,200 and 2,700 m). These stands occupied relatively gentle slopes with northerly and easterly exposures. Most were on soils derived from sandstone or quartzite.

Vegetation—This type is generally similar in composition to the POTR-PICO/SYOR c.t. except for the amount of shrubs in the undergrowth. Shrubs are frequently present, especially *Pachystima myrsinites*, *Rosa woodsii*, *Symphoricarpos* spp., and *Amelanchier alnifolia*, but they are never a prominent part of the undergrowth. The tree layer is a composite of *Populus tremuloides* and *Pinus contorta*, among which other conifers, especially *Abies lasiocarpa*, may be present in minor quantities. The undergrowth primarily is a mixture of herbaceous plants dominated by low-growing forbs. The prominence of either *Thalictrum fendleri*, *Geranium viscosissimum*, or *Osmorhiza chilensis* characterizes this undergrowth. Other frequent forbs are *Fragaria vesca* and *Achillia millefolium*. Occasionally, *Lathyrus* spp. may be abundant. The principal grasses usually are *Elymus glaucus* and *Agropyron trachycaulum*. Annuals are generally scarce.

Succession—The mixed aspen and conifer overstory in this seral type will eventually give way to complete dominance by *P. contorta*. Judging from the high constancy of *A. lasiocarpa*, the successional process should gradually lead to a type within the *A. lasiocarpa* coniferous forest climax series. In all probability, this would be within the *A. lasiocarpa / O. chilensis* habitat type (Mauk and Henderson 1984). At least some of the stands within this type could represent grazing degradations of the POTR-PICO/SYOR c.t. Heavy grazing may have caused a decrease in the amount of shrubs and graminoids typical of the latter.

Production—Tree production was evaluated on the basis of a single stand. Both stand basal area, 65 percent of which was aspen, and aspen growth measurements were in the mid-third percentile of all aspen stands. Basal area was 161 ft²/acre (36.9 m²/ha), aspen site index was 46 ft (13.9 m), and volume growth was 33 ft³ /acre/year (2.3 m³/ha/year). Aspen reproduction was 2,075 suckers/acre (5,127/ha). Only 199 established conifer seedlings were observed per acre (492/ha). Most of these were *A. lasiocarpa*, which suggests that stands within this type will eventually be dominated by this conifer. Undergrowth production was not measured. However, the type is generally less productive than most and will probably produce between 500 and 600 lb/acre (560 and 670 kg/ha) of air-dry herbage. The type is thus moderately good for the production of wood fiber but below average as livestock summer range. It also provides below-average habitat for wildlife because of the lack of structural diversity of the undergrowth.

Other—Communities of this composition were not identified as a separate type in any of the earlier aspen classifications.

Populus tremuloides—Pinus contorta/ Carex geyeri Community Type (POTR-PICO/CAGE c.t.)

Distribution—Most examples of this type were on the Targhee and Ashley National Forests where it accounted for 4 percent of the aspen communities. It occurred primarily along the Centennial Range and Yellowstone Plateau of eastern Idaho and in the Uinta Mountains of northeastern Utah. It was not observed farther south in Utah or in Nevada. The type inhabited a relatively broad elevational zone, from 6,200 to 9,400 ft (1,900 to 2,900 m), usually gentle slopes of different aspects, and soils derived primarily from sandstone or quartzite parent rock.

Vegetation—This minor type has little structural diversity and is fairly simple compositionally. Although its structural diversity is enhanced by the mixture of conifers and aspen in the tree stratum, the undergrowth consists primarily of low-growing graminoids and forbs. The tree layer is both *Populus tremuloides* and *Pinus contorta*, with the occasional presence of other conifers, particularly *Abies lasiocarpa* and *Pseudotsuga menziesii*. The undergrowth consists principally of either *Carex geyeri* or *Calamagrostis rubescens*, with sometimes appreciable amounts of such forbs as *Lupinus argenteus*, *Osmorhiza chilensis*, *Geranium viscosissimum*, or *Thalictrum fendleri*. Shrubs may sometimes be present, especially *Juniperous communis* and *Berberis repens*, but they are never prominent. Annuals are usually scarce.

Succession—This is a seral type in which *P. contorta* will eventually dominate the overstory. Given sufficient time, either *P. menziesii* or *A. lasiocarpa* is likely to replace the *P. contorta*. This uncertain successional sequence results from the presence of reproduction of *A. lasiocarpa* in some of the stands within this type and of *P. menziesii* reproduction in other stands. Comparisons of species compositions suggest that the type is most likely a seral stage within both the *A. lasiocarpa / C. rubescens* and *P. menziesii / C. rubescens* habitat types (Mauk and Henderson 1984; Steele and others 1983). Heavy grazing by cattle will likely result in a reduction of the graminoids that now tend to dominate the undergrowth and a corresponding increase in the abundance of the low forbs. Heavy sheep grazing is likely to have the opposite effect: a reduction of the forbs and an increase in the graminoids. In either event, as the conifers increase in the overstory, overall production of the herbaceous undergrowth will decrease.

Production—The POTR-PICO/CAGE c.t. appears to be moderately productive of trees, and slightly below average for the production of forage. Five stands were sampled for estimates of production. These had an average stand basal area of 139 ft^2/acre (31.8 m^2/ha), 85 percent of which was aspen. Aspen growth was in the midrange of all stands with a site index of 46 ft (14.0 m) at 80 years and volume production at stand maturity of 34 ft^3/acre/year (2.4 m^3/ha/year). Aspen reproduction averaged 652 suckers/acre (1,611/ha), and conifer reproduction averaged 176 established seedlings/acre (435/ha). Of these young conifers 70 percent were *A. lasiocarpa*, which indicates that despite the prominence of *P. contorta* in the tree cover, the type will eventually succeed to dominance by *A. lasiocarpa*.

Undergrowth production averaged in the lower third percentile of all stands, producing 619 lb/acre (694 kg/ha). Of this production, 60 percent consisted of forbs, 37 percent graminoids, and only 3 percent shrubs. However, the quality of the undergrowth as livestock forage was good, with 61 percent classified as desirable and only 3 percent as least desirable. The type is thus fairly good summer range for livestock, at least until increased shading by conifers in the tree layer further reduces undergrowth productivity. The type is only moderately good wildlife habitat because of the lack of structural diversity in the undergrowth.

Other—This type was not identified in earlier classifications. Communities with this composition were included in the *P. tremuloides—P. contorta / C. rubescens* c.t. in the Caribou and Targhee National Forests classification (Mueggler and Campbell 1982). The few communities identified as *P. tremuloides—P. contorta / Vaccinium scoparium* c.t. in the Utah classification (Mueggler and Campbell 1986) have been included in the new POTR-PICO/CAGE c.t.

Populus tremuloides—Pseudotsuga menziesii/Amelanchier alnifolia Community Type (POTR-PSME/AMAL c.t.)

Distribution—This incidental type, although fairly widespread, is most common in the northern half of the Region. It accounts for 4 percent of the aspen communities on the Targhee National Forest. The type was observed as far north as the Yellowstone Plateau in eastern Idaho and as far south as the LaSal Mountains in southeastern Utah. It was not seen in Nevada. This is a low to moderate elevation type, with almost 90 percent of the stands growing at less than 7,500 ft (2,300 m) and some as low as 5,600 ft (1,700 m). These stands were usually on moderate to steep slopes of various aspects and on soils derived primarily from sedimentary parent rock.

Vegetation—The vegetation of the POTR-PSME/AMAL c.t. is structurally diverse. It consists of a complex multilayered assemblage of trees, shrubs, and herbs. The characterizing feature of the overstory is the prominence of *Pseudotsuga menziesii* along with the prevalent *Populus tremuloides*. A tall shrub stratum is generally dominated by *Amelanchier alnifolia*, *Prunus virginiana*, or *Acer grandidentatum*. A distinct low shrub layer also exists in which *Symphoricarpos* spp., *Rosa woodsii*, or *Pachystima myrsinites* are prominent. *Berberis repens* also may be abundant. The herbaceous stratum consists primarily of a mixture of graminoids and low-growing forbs. The most frequently occurring and abundant of these are *Elymus glaucus*, *Thalictrum fendleri*, *Osmorhiza chilensis*, and *Geranium viscosissimum*. Occasionally, *Carex geyeri*, *Calamagrostis rubescens*, or *Arnica cordifolia* may be abundant. Although annuals are not uncommon, they are seldom abundant.

Succession—This type is a successional stage leading to a *P. menziesii* forest climax. Undergrowth species' similarities suggest the type most likely represents a seral stage within the *P. menziesii / O. chilensis* habitat type (Mauk and Henderson 1984; Steele and others 1983), but similarity of species' constancies are also high with the *P. menziesii / Acer glabrum* and *P. menziesii / B. repens* habitat types (appendix E). Heavy livestock use is likely to cause a decrease in abundance of *S. oreophilus* and *A. alnifolia* and an increase in less palatable species such as *B. repens*, *A. cordifolia*, and *G. viscosissimum*. In addition, heavy use by sheep will tend to suppress *O. chilensis* and *T. fendleri* and benefit the graminoids. On the other hand, heavy cattle use will tend to suppress the graminoids and favor the forbs.

Production—Five stands were sampled to evaluate productivity potential. The type is fairly productive of trees. Total tree basal area, 89 percent of which was aspen, averaged 170 ft^2/acre (39.0 m^2/ha). Site index for aspen at 80 years averaged 56 ft (17.2 m), and estimated volume production for aspen averaged 48 ft^3/acre/year (3.3 m^3/ha/year). All of these measurements were within at least the upper third of all aspen stands. Aspen reproduction was abundant, averaging 2,698 suckers/acre (6,309/ha). Established conifer seedlings, though not nearly so numerous, clearly indicate the successional status of the type. An average of 214 seedlings/acre (529/ha) of *P. menziesii* and 188 seedlings/acre (465/ha) of *A. lasiocarpa* were present. This suggests that many of the stands within this type will eventually succeed to *A. lasiocarpa* dominance.

The annual production of undergrowth was generally moderate, with an average of 922 lb/acre (1,034 kg/ha). This consisted of an average 45 percent forbs, 41 percent shrubs, and 14 percent graminoids. The undergrowth is in the mid-range of suitability as livestock forage. Of the cover 51 percent was classified as desirable and 45 percent as of intermediate suitability. The type provides at least moderately good summer range for livestock, particularly for sheep, because of the relative abundance of forbs and shrubs. The type is good wildlife habitat. Both the tree overstory and the undergrowth have good structural diversity, and the undergrowth consists of a diverse assemblage of species as well.

Other—Communities of this structure and composition were recognized by this name in both the Utah aspen classification (Mueggler and Campbell 1986) and the Caribou and Targhee National Forests classification (Mueggler and Campbell 1982). They were recognized in the Bridger-Teton classification (Youngblood and Mueggler 1981) as the *P. tremuloides—P. menziesii / Spirea betulifolia* c.t. Aspen-dominated communities seral to *P. menziesii* coniferous forest types are present in Colorado (Johnston and Hendzel 1985), but this specific type was not identified.

Populus tremuloides—Pseudotsuga menziesii/Symphoricarpos oreophilus Community Type (POTR-PSME/SYOR c.t.)

Distribution—The POTR-PSME/SYOR c.t. is an infrequent seral type that is widely distributed in the Region. It occurred as far north as the Yellowstone Plateau on the Targhee National Forest and as far south as the Aquarius Plateau on the Dixie National Forest. The type was not seen in Nevada. The greatest concentration of stands appeared to be in southern Idaho and northern Utah. It appears adapted to relatively low and moderate elevations. Almost 90 percent of the stands sampled were between 6,000 and 7,500 ft (1,800 and 2,300 m). The majority of stands occupied gentle to moderately steep slopes, irrespective of aspect. Although they grew on a wide variety of soils, most were on soil derived from sedimentary parent rock.

Vegetation—The vegetation is similar to that of the POTR-PSME/AMAL c.t. except for a lack of a tall shrub stratum. The tree layer is a mixture of *Populus tremuloides* and *Pseudotsuga menziesii*. Occasionally, *Abies lasiocarpa* may be present, but it is not prominent. The undergrowth is characterized by a low shrub stratum primarily of *Symphoricarpos* spp. and *Rosa woodsii*, often with minor quantities of other species. The herbaceous layer is similar to that in the POTR-PSME/AMAL c.t. The graminoids *Elymus glaucus*, *Calamagrostis rubescens*, and sometimes *Carex geyeri* can be abundant. The most commonly encountered forbs are *Thalictrum fendleri*, *Osmorhiza chilensis*, and *Geranium viscosissimum*. Occasionally, *Arnica cordifolia* is abundant. Annual plants are frequently present but usually sparse.

Succession—As with the POTR-PSME/AMAL c.t., this type is a seral stage within the *P. menziesii* coniferous forest climax series, likely within the *P. menziesii / O. chilensis*, *P. menziesii / C. rubescens*, or possibly *P. menziesii / Berberis repens* habitat types (appendix E). Heavy grazing by cattle will likely result in a decrease in the graminoids and an increase in the forbs. Heavy grazing by sheep will likely cause the *Symphoricarpos* spp. and more palatable forbs to decrease and favor the production of the graminoids. As the conifers gain dominance in the forest canopy, overall production of the undergrowth, particularly the herbaceous species, will decrease.

Production—Tree production is less and undergrowth production more in this type than in the POTR-PSME/AMAL c.t. Total tree basal area of the six stands sampled for production averaged only 137 ft^2/acre (31.5 m^2/ha); 86 percent of this was aspen. Site index for aspen averaged 54 ft (16.3 m), and estimated volume production of aspen at stand maturity averaged 44 ft^3/acre/year (3.1 m^3/ha/year). All of these measurements were in the mid-third percentile of all aspen stands. Aspen reproduction was a moderate 644 suckers/acre (1,593/ha). The primary conifers invading these communities were *P. menziesii* at 198 established seedlings/acre (489/ha) and *A. lasiocarpa* at 122 seedlings/acre (301/ha). Overall, this seral type is moderately productive of wood fiber.

The annual production of undergrowth was in the upper quarter percentile of all aspen stands with an average 1,257 lb/acre (1,409 kg/ha) of air-dry herbage. This averaged 50 percent graminoids, 39 percent forbs, and 11 percent shrubs. It was considered above average in suitability as summer forage for livestock with 55 percent of the cover classified as desirable and 38 percent as intermediate. It appears about equally suitable as summer range for both cattle and sheep. Although seen as fairly good wildife habitat, the lack of a tall shrub stratum somewhat limits its value. Thus, the POTR-PSME/SYOR c.t. is better livestock summer range than the POTR-PSME/AMAL c.t., but it is not as good a habitat for wildlife.

Other—Aspen communities of this composition were identified under this name in the Caribou and Targhee National Forests classification (Mueggler and Campbell 1982). They were included as a minor part of the *P. tremuloides—P. menziesii / C. rubescens* c.t. in the Bridger-Teton National Forest classification (Youngblood and Mueggler 1981).

Populus tremuloides—Pseudotsuga menziesii/Juniperus communis Community Type (POTR-PSME/JUCO c.t.)

Distribution—This seral type occurs infrequently in Utah and eastern Nevada. It is found as far north as the south slope of the Uinta Mountains in northeastern Utah and as far south as the Paunsaugunt Plateau in extreme southern Utah. The type is most often encountered on the Ashley and Fishlake National Forests where it accounts for 4 percent of the aspen communities. A single stand was seen on the Snake Range in eastern Nevada. This apparently is an intermediate elevation type. All 13 stands examined were between 7,500 and 9,200 ft (2,300 and 2,800 m). Stands were observed on a variety of slopes, exposures, and soils.

Vegetation—This is the driest of the three aspen types identified as successional to climax *Pseudotsuga menziesii* forests. The vegetation is characterized by the conspicuous presence of *P. menziesii* along with *Populus tremuloides* in the tree layer, the absence of a tall shrub stratum, and the prominence of *Juniperus communis* in the low shrub layer. A wide variety of other conifers occurred in the type, but *P. menziesii* is characterizing. *Symphoricarpos oreophilus* and *Berberis repens* are frequently abundant members of the low shrub layer. The herbaceous undergrowth is characteristically sparse in cover but highly variable in composition. No single herb appears to typify the type. The most commonly encountered graminoids are *Agropyron trachycaulum*, *Stipa occidentalis*, *Sitanion hysterix*, and *Carex rossii*. The most common forb is *Thalictrum fendleri*. Occasionally, *Astragalus miser*, *Taraxacum officinale*, or *Lathyrus* spp. are abundant. Annuals are infrequent.

Succession—The type is recognized as a seral stage within the *P. menziesii* climax forest series and is most closely related to the *P. menziesii / B. repens* and *P. menziesii/S. oreophilus* habitat types described by Mauk and Henderson (1984) for northern Utah and by Youngblood and Mauk (1985) for central and southern Utah. Heavy livestock grazing will tend to suppress the production of *S. oreophilus*, *T. fendleri*, and the palatable grasses and favor the production of *B. repens*, *A. miser*, and *T. officinale*. As the conifer canopy becomes more dense, the undergrowth will become even more depauperate.

Production—A single stand was measured for productivity. This limited sample suggests that the potential for production of wood fiber is above average, but the potential for production of livestock forage is well below the average of most aspen communities. Total tree basal area was 192 ft²/acre (44.2 m²/ha), aspen site index was 56 ft (17.0 m), and estimated volume production of aspen wood was 47 ft³/acre/year (3.3 m³/ha/year). As with most of the community types in which *J. communis* is prominent in the undergrowth, total annual herbage production is not great. In the sample stand it was only 295 lb/acre (331 kg/ha), which is in the lowest quartile of all stands sampled. Species composition indicates that this meager amount of undergrowth is of only intermediate value as forage. The value of the type as wildlife habitat is not great because of the lack of structural diversity in the undergrowth.

Other—These communities were identified by the same name in the Utah classification (Mueggler and Campbell 1986). They have not been reported to occur outside of the Intermountain Region.

Populus tremuloides—Pseudotsuga menziesii/Calamagrostis rubescens Community Type (POTR-PSME/CARU c.t.)

Distribution—This minor, seral community type apparently occurs only in the extreme northern part of the Region. It was observed along the Centennial Range on the Targhee National Forest in eastern Idaho and in the Gros Ventre Range on the Bridger-Teton National Forest in western Wyoming. The type was not encountered either in Utah or Nevada. It is a middle elevation type for this latitude. Sampled stands ranged from 6,400 to 7,800 ft (2,000 to 2,400 m). Most of the stands were on northerly exposures and on a variety of different soils.

Vegetation—Composition of the POTR-PSME/CARU c.t. was determined from a sample of seven stands. The type is characterized by the prominence of *Pseudotsuga menziesii* in the dominantly *Populus tremuloides* tree layer, combined with a structurally simple undergrowth of graminoids and forbs. The predominantly herbaceous undergrowth is usually dominated by *Calamagrostis rubescens* but occasionally by *Carex geyeri*. The only other grass that occurs in most stands is *Elymus glaucus*. Although a variety of low-growing forbs are usually present, they are seldom abundant. The most frequent forbs are *Fragaria vesca*, *Geranium viscosissimum*, *Thalictrum fendleri*, *Osmorhiza chilensis*, and *Lupinus argenteus*. Low shrubs, especially *Symphoricarpos* spp., *Rosa woodsii*, and *Berberis repens*, are not unusual but generally are not prominent. Annual plants are scarce.

Succession—The type is a seral stage within the *P. menziesii* forest climax series. Comparisons of species constancies (appendix E) suggest a close relationship to the *P. menziesii / C. rubescens* habitat type (Steele and others 1983). Heavy use by cattle would likely reduce the abundance of graminoids and tend to favor increased production of the less palatable forbs such as *F. vesca*, *G. viscosissimum*, and *L. argenteus*. Heavy grazing by sheep would tend to favor production of the graminoids over the more palatable forbs and the few shrubs, especially *S. oreophilus* and *R. woodsii*.

Production—The single stand sampled suggests that the type is intermediate in its potential to produce trees and good as summer range for livestock. Total tree basal area, 91 percent of which was aspen, was 169 ft²/acre (38.8 m²/ha). Site index for aspen was 52 ft (15.7 m), and volume production was 41 ft³/acre/year (2.9 m³/ha/year).

Aspen reproduction was fairly good. Undergrowth herbage production was in the upper quartile of all stands, at 1,418 lb/acre (1,590 kg/ha). Most of this consisted of graminoids, 64 percent. Forbs were 35 percent and shrubs only 1 percent. This undergrowth is suitable as livestock forage, with 64 percent of the cover in the desirable category. This forage is better suited for cattle grazing than for sheep. The type has only limited value as wildlife habitat because of the lack of shrubs in the undergrowth and lack of species diversity.

Other—Communities of this composition were identified under the same name in the Bridger-Teton National Forest classification (Youngblood and Mueggler 1981) and in the Caribou and Targhee National Forests classification (Mueggler and Campbell 1982).

Populus tremuloides—Abies concolor/ Poa pratensis Community Type (POTR-ABCO/POPR c.t.)

Distribution—This minor seral community type was observed only in southern Utah on the Dixie and Fishlake National Forests and in eastern Nevada on the Humboldt National Forest. The type occurs on both the Markagunt Plateau and Tushar Mountains of southern Utah and in the Snake and Schell Creek Ranges of eastern Nevada. All 12 sampled stands grew at elevations between 8,000 and 8,800 ft (2,400 and 2,700 m). Most were on fairly gentle slopes of various exposures and conformations and on soils derived from a wide variety of parent rock.

Vegetation—This is one of three types in which *Abies concolor* is prominent in the tree layer along with *Populus tremuloides* and which appears to be successional to *A. concolor* dominance. *Pseudotsuga menziesii* may also be part of the tree component, but it is not prominent. The undergrowth is a fairly depauperate mixture of herbs, primarily grasses. The herb layer generally is dominated by *Poa pratensis*. Other common and sometimes abundant grasses are *Bromus carinatus*, *Agropyron trachycaulum*, and *Stipa occidentalis*. The most frequent forbs are *Taraxacum officinale*, *Achillea millefolium*, and *Thalictrum fendleri*. Shrubs may be present in minor amounts, especially *Symphoricarpos oreophilus*, but they are never abundant enough to form a distinct stratum.

Succession—The type is a successional stage within the climax *A. concolor* coniferous forest series, but the particular habitat type is uncertain. It also is a grazing-degraded type, judging from the constancy and relative abundance of such species as *P. pratensis* and *T. officinale*. Stands in this type once likely would have been classified as belonging to the POTR-ABCO/SYOR c.t. Abusive grazing undoubtedly reduced the amount of *S. oreophilus* and the grazing sensitive forbs and grasses and permitted an increase in those species able to withstand grazing pressures, such as *P. pratensis* and *T. officinale*.

Production—The productivity of this type was not sampled. The undergrowth, however, was generally poor in both production and in species diversity. Therefore, the type is below-average summer range for livestock. The annual production of undergrowth herbage probably ranges between about 400 and 600 lb/acre (450 and 670 kg/ha), most of which is graminoids. Wildlife habitat values are also below average for aspen communities because of the lack of structural diversity of the undergrowth and because of poor overall species diversity.

Other—Johnston and Hendzel (1985) recognized the successional status of aspen to *A. concolor* in southern Colorado but did not identify specific community types. In the Utah aspen classification (Mueggler and Campbell 1986), communities of this general composition were placed in the *P. tremuloides—A. concolor/Juniperus communis* c.t.

Populus tremuloides—Abies concolor/ Arctostaphylos patula Community Type (POTR-ABCO/ARPA c.t.)

Distribution—This seral aspen type has the most restricted distribution of any described for the Region. It appears to be confined to the Snake Range of the Humboldt National Forest in eastern Nevada. Seven stands in this area were sampled. These stands grew at elevations between 8,300 and 9,500 ft (2,500 and 2,900 m). They occupied moderately steep northerly and easterly slopes, usually at mid-slope positions, and soils derived primarily from quartzites.

Vegetation—The vegetation of this seldom seen type is unusual in that it consists of a mixed *Populus tremuloides* and *Abies concolor* tree stratum under which the most abundant plant is the low, distinctive shrub *Arctostaphylos patula* (fig. 33). In about half the seven stands examined, *Pseudotsuga menziesii* was also present in the tree layer or as reproduction. *Berberis repens* is the second most frequent member of the shrub component. The herbaceous stratum is generally sparse but is characterized by the presence of the sedge *Carex rossii*. The next most common graminoid is *Poa fendleriana*. No single forb appears characteristic of this type. The most commonly observed are *Stellaria jamesiana* and *Penstemon watsonii*, which occurred in about half the stands. Annuals appear to be scarce.

Succession—This type is primarily a seral stage within the *A. concolor/A. patula* habitat type described by Youngblood and Mauk (1985). The occurrence of *A. patula* in the undergrowth, combined with the presence of *A. concolor*, is distinctive. This again demonstrates the environmental flexibility of aspen serving as a seral species. Those stands that appear successional to *P. menziesii* dominance should be considered seral stages within the *P. menziesii/A. patula* habitat type.

Production—This type was not sampled for production, but the undergrowth typically contains few grasses or forbs. Most of the undergrowth production is the evergreen, unpalatable shrub *A. patula*. Probably fewer than 300 lb/acre (336 kg/ha) of herbaceous material is present

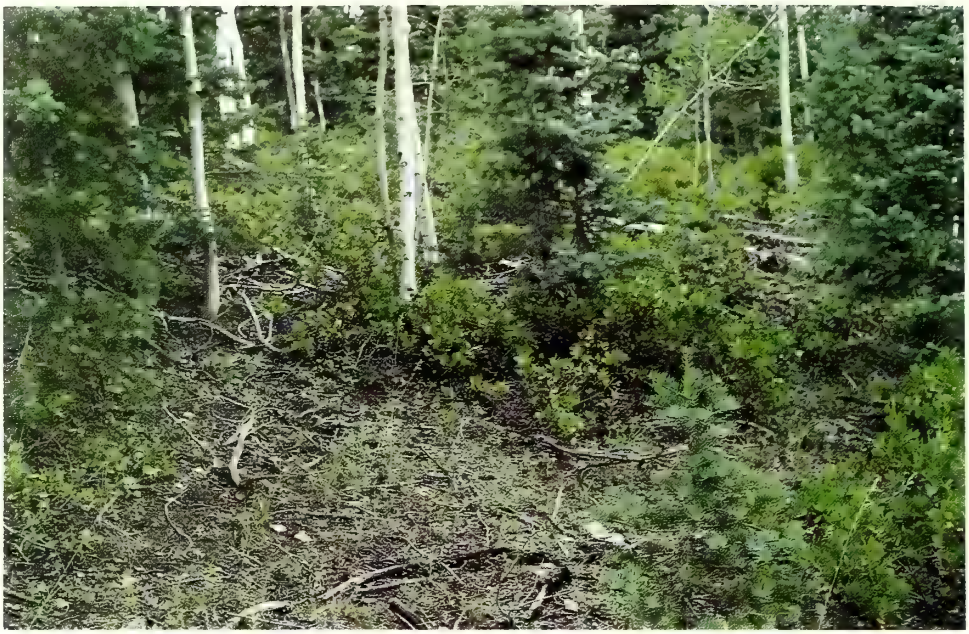

Figure 33—The *Populus tremuloides/Arctostaphylus patula* c.t. was observed only in the Snake Range of east-central Nevada. It is an unusual type in that the distinctive evergreen shrub *A. patula* (manzanita) is a prominent component of the rather sparse undergrowth. This is a seral type in which the conifer *A. concolor* will eventually dominate the tree layer.

in most stands. Consequently, the type is poor summer range for livestock. It is also generally poor habitat for wildlife because of the sparse undergrowth and lack of palatable species.

Other—Communities in which *A. patula* is undergrowth to a mixed *P. tremuloides—A. concolor* overstory have not been reported previously either in the Intermountain Region or elsewhere.

Populus tremuloides—Picea pungens Cover Type (POTR-PIPU cover type)

Distribution—This incidental seral type, scattered intermittently across Utah, ranges from the south slope of the Uinta Mountains in the northeast to the Paunsaugunt Plateau in the south. The type appears most abundant on the Dixie and Fishlake National Forests where it accounts for 4 percent of the aspen communities. It was not seen in either Wyoming, Idaho, or Nevada. The type ranged in elevation from 7,400 ft (2,300 m) in the northern part of Utah to 9,100 ft (2,800 m) in the south. Stands occupied all exposures of moderately steep slopes, in mid- to low-slope positions, and soils derived from both igneous and sedimentary parent materials.

Vegetation—This minor cover type was defined to accommodate those aspen stands in which *Picea pungens* is the primary species associated with *Populus tremuloides* in the tree layer and which did not satisfactorily fit other defined types. The diversity of undergrowth vegetation did not permit partitioning beyond the cover type level. The most constant species in the undergrowth of the 15 stands placed in this type is *Juniperus communis*, which occurs in the majority of stands. In general, the shrubby and herbaceous undergrowth is fairly sparse and consists of relatively low-growing species. *Taraxacum officinale* and *Achillia millefolium* were observed in over three-fourths of the stands, whereas *Symphoricarpos oreophilus*, *Bromus anomalus*, *Fragaria vesca*, and *Poa pratensis* were found in almost half the stands.

Succession—Apparently the aspen is being slowly replaced by *P. pungens*. As the overhead conifer cover increases in density, the sparse undergrowth will likely become even less productive. Most of the stands in this cover type reflect the results of a rather intense grazing history, judging from the relative prominence of such species as *T. officinale* and *P. pratensis*. Few grazing-susceptible plants remain.

Production—This type was not sampled for production. However, certain undergrowth similarities with other types in which *J. communis* is a major undergrowth component suggest that it produces considerably less livestock forage than most aspen communities. Most stands in the type probably produce less than 500 lb/acre (560 kg/ha) of annual growth. It is thus rather poor summer range for livestock. The type is only poor to fair wildlife habitat because of the general lack of hiding cover in the rather sparse undergrowth.

Other—Aspen communities successional to *P. pungens* dominance have been reported to occur in Colorado (Johnston and Hendzel 1985). There, they were identified as a seral stage in a *P. pungens/Carex geyeri* habitat type.

Populus tremuloides—Pinus flexilis Cover Type (POTR-PIFL cover type)

Distribution—The POTR-PIFL cover type, though seldom seen, is widely scattered across the Region. It occurred as far north as the Gros Ventre Range in western Wyoming, as far south as the Paunsaugunt Plateau in southern Utah, and as far west as the Snake Range in eastern Nevada. The greatest concentration of the type is in eastern Nevada. This is a relatively high elevation type. The only stand encountered below 9,000 ft (2,750 m) was in Wyoming at 8,700 ft (2,650 m). Most stands occurred on fairly steep south-facing slopes and on a variety of soil parent materials.

Vegetation—*Pinus flexilis* occurs as a secondary conifer in many of the other aspen community types but never to the extent where it appears to be a potential dominant over other conifer species. A type was needed, however, to accommodate those aspen stands that contain appreciable amounts of only *P. flexilis* and *Populus tremuloides* in the tree strata. Nine such stands were encountered. Further partitioning of this cover type into different community types does not appear warranted. No single undergrowth species occurred in all nine stands. However, more than two-thirds of the stands contained *Symphoricarpos oreophilus*, *Berberis repens*, *Carex rossii*, *Agropyron trachycaulum*, *Achillea millefolium*, *Trifolium gymnocarpum*, *Stellaria jamesiana*, and *Penstemon watsonii*. Over half the stands contained substantial amounts of *Juniperus communis* and *Poa fendleriana*. Annual plants were few.

Succession—Whether *P. flexilis* will ever become dense enough in these stands to completely suppress the aspen is questionable. However, for the sake of consistency, the cover type is considered a seral type leading to a *P. flexilis*-dominated coniferous forest climax type.

Production—Although not sampled for production, the undergrowth in this type appears to be fairly sparse and probably ranks within the lower quartile of all aspen stands, generally producing less than 400 lb/acre (448 kg/ha) of air-dry herbage. The type would thus be poor summer range for livestock, especially considering the relatively low palatability of many of the undergrowth components. The value of the type as wildlife habitat would probably be low to moderate considering the limited diversity of vegetation structure and amount of forage.

Other—Johnston and Hendzel (1985) observed that aspen can be a seral species in *P. flexilis* stands in Colorado, but they indicated that the association of these two species is somewhat unusual. They believe that this seral community occurs in the *P. flexilis / J. communis* habitat type.

Populus tremuloides—Pinus ponderosa Cover Type (POTR-PIPO cover type)

Distribution—This infrequent seral type was observed at two principal locations: the south slope of the Uinta Mountains in northeastern Utah, and the mountains and high plateaus of extreme southern Utah. An area of concentration appeared to be the Markagunt Plateau of the Dixie National Forest. In fact, this type accounted for 8 percent of the aspen communities on the Dixie. Interestingly, it occupied the same elevation regardless of whether it was in northern or southern Utah; 15 of the 18 sampled stands were between 8,000 and 8,900 ft (2,400 and 2,700 m). Almost all these stands were on gentle, less than 20 percent slopes of a variety of exposures. They equally occupied soils derived from igneous and sedimentary parent rock.

Vegetation—This minor cover type is designated to accommodate those aspen communities in which *Pinus ponderosa* is the prominent conifer associated with *Populus tremuloides* (fig. 34). This conifer occurs in other types, but only secondarily to other conifers that appear better adapted to the site and more shade tolerant than *P. ponderosa*. As one would expect, the undergrowth in the POTR-PIPO cover type is relatively sparse and consists of species adapted to fairly dry environments. Further partitioning into community types does not appear justified. No single undergrowth species occurred in all 18 stands examined. In fact, only *Juniperous communis* occurred in more than two-thirds of the stands, and only half the stands contained the next most common species: *Symphoricarpos oreophilus*, *Berberis repens*, *Poa fendleriana*, *Taraxacum officinale*, and *Achillea millefolium*. Annuals are generally scarce.

Succession—The *P. tremuloides* in the tree cover appears susceptible to slow replacement by *P. ponderosa*. Even though *P. ponderosa* tends to grow in fairly open stands, the increase in competition (probably primarily from shading) apparently is sufficient to prevent aspen reproduction. Consequently, those stands that contain *P. ponderosa* reproduction eventually will become dominated by this conifer. The generally sparse undergrowth is unlikely to change appreciably as the overstory changes from aspen dominance to conifer dominance.

Production—Production on the POTR-PIPO cover type was sampled on three stands. The type is moderately productive of wood fiber. Total tree basal area averaged 160 ft^2/acre (36.8 m^2/ha), of which 72 percent was aspen. Site index at 80 years for aspen was 46 ft (13.9 m), and estimated volume growth was 33 ft^3/acre/year (2.3 m^3/ha/year). All of these measurements ranked in the mid-third percentile of all aspen stands. Aspen reproduction averaged 735 suckers/acre (824/ha), and established seedlings of *P. ponderosa* averaged 197 seedlings/acre (487/ha). The number of aspen trees averaged a moderate 735 stems/acre (824/ha). Despite the current dominance by aspen, the established conifer seedlings indicate that *P. ponderosa* will eventually gain dominance.

The undergrowth consisted of a fairly balanced mixture of graminoids at 39 percent, forbs at 38 percent, and shrubs at 23 percent. This undergrowth was classified as high in forage suitability; 58 percent was desirable and 39 percent intermediate. This minor seral type, therefore, is moderate to good summer range for livestock. In contrast to most of the other seral types, succession to conifer dominance is unlikely to depress undergrowth production

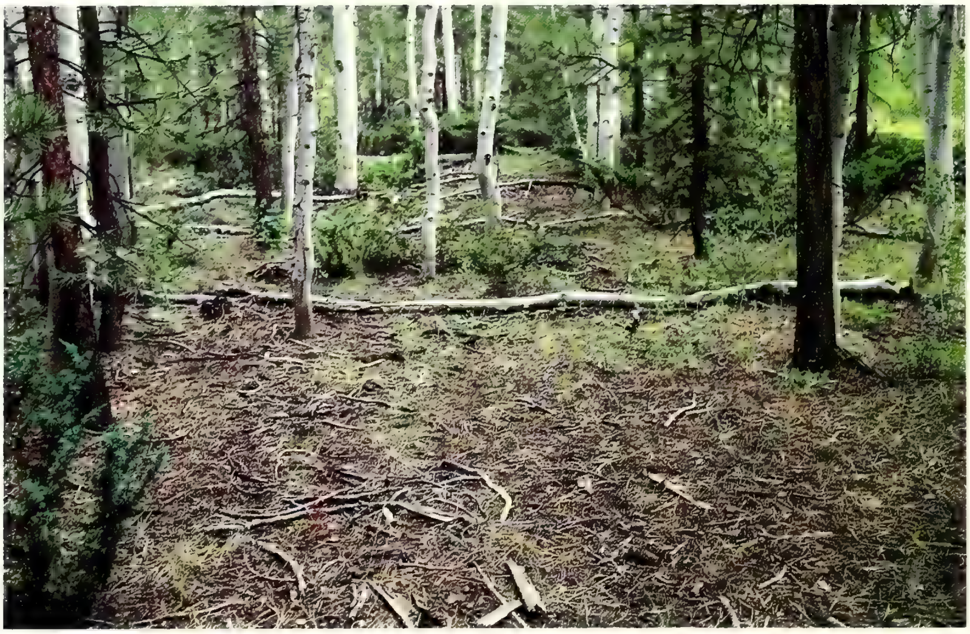

Figure 34—In a few areas of the Intermountain Region, aspen appears to be a seral species in communities that eventually will be dominated by *Pinus ponderosa.* These situations, encountered primarily on the Markagunt Plateau in southern Utah and on the south slope of the Uinta Mountains in northeastern Utah, are designated the *Populus tremuloides-P. ponderosa* cover type.

greatly. The type is only mediocre wildlife habitat because of the general lack of structural diversity in the undergrowth.

Other—In the Utah aspen classification (Mueggler and Campbell 1986), both a *P. tremuloides—P. ponderosa / Quercus gambelii* and a *P. tremuloides—P. ponderosa / J. communis* c.t were identified, but the validity of this separation was uncertain. I have since decided to combine these communities where aspen is associated with *P. ponderosa* into a single cover type. The association of aspen with *P. ponderosa* was noted in Colorado by Johnston and Hendzel (1985), who considered their stands to be seral stages in the *P. ponderosa / Q. gambelii—S. oreophilus* habitat type.

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APPENDIX A: DETAILS OF STUDY METHODS

The development of a classification for the aspen forests of the Intermountain Region occurred in phases over approximately 8 years. Following an initial period of gaining familiarity with the broad variability in composition of aspen-dominated forests and the compositional complexities created by environment, natural succession, and often severe grazing disturbance, I adopted a conceptual approach to the development of a classification of these communities and devised preliminary sampling and analysis techniques.

A major decision at the outset was to use the "community type" rather than "habitat type" concept of classification development. This was necessitated by the uncertain successional status of the majority of the aspen communities and recognition of probable grazing alterations of this historically important summer forested range for sheep and cattle. Habitat types, as conceptualized by Daubenmire and Daubenmire (1968), are aggregations of land units capable of supporting similar climax plant communities. Habitat types are initially defined by differences in species composition of climax communities, and thus require ample representation of little-disturbed climax communities upon which to base type separations. Community types, on the other hand, are aggregations of similar plant communities based on existing vegetation composition, regardless of successional status or alteration caused by excessive grazing. As with habitat types, community types use the vegetation as an environmental integrator and thus, it is hoped, reflect major environmental differences. Unlike habitat types, however, community types also reflect vegetation composition differences caused by seral sequences and biotic pressures. Community types may thus represent either climax plant associations or successional stages leading toward climax plant associations or grazing-altered communities within climax plant associations. In any event, resource managers in the field must be able to recognize and contend with this existing vegetation. Once community types are defined, efforts can be directed toward establishing successional relationships and linking the seral types to known habitat types.

Collection of data began on the Bridger-Teton National Forest in western Wyoming the summer of 1978. Youngblood and Mueggler (1981) then analyzed these data and developed a preliminary classification with community type descriptions specific to this area. This was followed by Mueggler and Campbell's (1982) work on the Caribou and Targhee National Forests in southeastern Idaho in 1979 and the development of a preliminary classification and description of community types specific to these two Forests. Aspen stands on the National Forests in northern Utah were inventoried in 1980 and 1981 and in southern Utah in 1981 and 1982. A preliminary classification of aspen community types and type descriptions were then developed for Utah (Mueggler and Campbell 1986). In the summer of 1984 field studies were concentrated on the Humboldt and Toiyabe National Forests of Nevada. During the course of the study, only minor changes were made in sampling procedures to meet data needs not recognized initially. In addition, I used stand composition data related to separate studies on aspen to conifer succession furnished by cooperators, when these data were reliable and in suitable form. Less than 10 percent of the total data base was obtained from these other studies.

The preliminary classifications for the four geographical areas (western Wyoming, southeastern Idaho, Utah, and Nevada) were developed more-or-less independently from independent data sets rather than by extension from one area to the next. Also, my concepts of the importance of community structure and the indicator significance of certain undergrowth species to classification development changed as my understanding of community variability and succession improved during the course of the overall study. It thus became essential to analyze the composite data set as a whole and to develop a unified classification for the Intermountain Region incorporating my improved understanding of aspen community relations.

Field Methods

We required a large number of sample plots to adequately encompass and replicate the variation in the seral and stable aspen communities found within the Intermountain Region. Data on composition of the overstory and undergrowth vegetation were needed for development of the actual classification. At the same time we needed to acquire data on stand structure, productivity, and environment to serve as a basis for describing productivity and environmental factors of the subsequently defined community types. However, acquiring quantitative data on stand structure, undergrowth productivity, and certain other desired factors can be laborious and severely restricts the number of stands that can be examined when resources are limited. Our inability to measure all stands at the desired intensity and still acquire the large number of stands needed to serve as a basis for a reliable classification became apparent during the first year in western Wyoming where all stands were sampled at the same intensity. In subsequent years, a dual sampling approach was used consisting of both general reconnaissance and intensively sampled plots, except in Nevada where time did not permit intensive sampling. One person sampled the reconnaissance plots, working independently from a two-person crew responsible for sampling the more time-consuming intensive plots. On the reconnaissance plots, species composition was estimated, and some environmental factors were characterized. The intensive plots yielded data on stand structure, age, productivity, and environment, as well as on species composition.

Sampling was concentrated in those areas of the Region where aspen formed a conspicuous part of the overall vegetation complex. (However, time did not permit the inclusion of the Sawtooth and Challis National Forests in south-central Idaho even though these two forests contain considerable amounts of aspen.) The usual method of locating aspen communities for sampling was to travel forest roads looking for reasonably accessible candidate stands. Only two criteria were used for stand selection:

at least 50 percent of the tree canopy cover had to consist of aspen, and the stand needed to be large enough to contain a single macroplot within an apparently uniform environment. Our intent was to sample the full environmental range where aspen expressed dominance. Neither successional status nor grazing influences were considerations in stand selection. Therefore, even though the actual selection of stands for sampling was subjective, the method of selection avoided preconceived bias that could affect the resulting classification.

Intensive sampling of the Idaho and Utah stands centered upon a single $^1/_{13}$-acre (314-m^2) circular macroplot established in a relatively uniform and representative portion of the stand. Ecotones at stand margins and atypical openings were avoided, as were clonal ecotones where a stand had more than one discernible aspen clone. The following tree data by species were collected on each macroplot: an ocular estimate of overhead canopy cover; reproduction as number of stems with heights less than 4 inches (1 dc), 4 to 12 inches (1 to 3 dc), and 12 to 55 inches (3 to 14 dc); number of stems by 2-inch (5-cm) diameter at breast height (d.b.h.) size classes; and age, height, and d.b.h. of individual trees selected to represent the dominants. (Tree data from the Wyoming stands were not collected in the same manner as from Idaho and Utah and therefore are not included in the tree production summaries.)

We determined species composition of the undergrowth shrubs and herbs by estimating canopy cover by species from a careful examination of the entire macroplot. We also estimated canopy cover for the vegetation classes of shrubs, graminoids, forbs, and annuals. Undergrowth biomass was determined by a combination of estimating and clipping current year's growth of shrubs below 5 ft (1.5 m) high and herbs on three sets of microplots randomly distributed on the macroplot. Each set of microplots consisted of a cluster of five circular 5.4-ft^2 (0.5-m^2) plots on which the current growth on four was estimated as a percentage of the fifth, which was then clipped. The clipped material was saved and later dried for 48 h at 158 °F (70 °C). The percentage figures from the four estimated plots were then converted to dry weight. An estimated correction was applied at the time of sampling to adjust the weights for sampling either before or after the time of peak standing crop, and to correct for obvious livestock use. Although they were highly subjective, we considered these adjustments necessary to compensate for obvious production distortions caused by time of sampling use. Therefore, undergrowth production data are based on 15 microplots per stand.

The following environmental factors were determined for each intensively sampled stand: elevation, aspect, percent slope, landform, soil parent material, depth of melanized layer, and estimates of rooting depth, soil rockiness, and soil texture. Also recorded were location, evidence of succession, livestock use, and other interpretive information.

The considerably more rapid reconnaissance technique of sampling consisted of choosing approximately $^1/_{10}$ acre ($^1/_{25}$ ha) of uniform portion of the stand to be sampled and estimating selected vegetation characteristics. Canopy cover of each tree species was estimated separately for that portion over 4.6 ft (1.4 m) high and the reproduction under this height. Percentage canopy cover for each shrub and herbaceous species, as well as for vegetation classes, was estimated after carefully examining the sample area. Elevation, aspect, landform, soil parent material, and stand location were recorded, as were interpretive information related to succession and animal use.

In this manner we accumulated data from 2,137 stands (or from similar separate studies) to serve as a basis for developing a community type classification for aspenlands in the Intermountain Region. Almost a fourth of these stands were sampled intensively and the remainder by general reconnaissance.

No single flora adequately described all of the plant species encountered throughout the Intermountain Region. Elements from at least three major floristic provinces exist. Species from the Northern Rocky Mountains extend into eastern Idaho and western Wyoming. Southern Rocky Mountain species extend into eastern Utah. The remainder of Utah and Nevada are primarily within the Great Basin floristic province (Cronquist and others 1972). Nomenclature relied heavily upon Hitchcock and Cronquist (1973) for the northern part of the Region, and upon Harrington (1954), Welsh and Moore (1973), and Cronquist and others (1972, 1977, 1984) for the remainder of the Region. Of the over 550 plant species evaluated during the course of this study, only 184 of the more important are included in the tables showing vegetation composition by community types (appendix F).

Analysis Methods

Before placing the field data on computer file for analysis, we confirmed the identification of all voucher plant specimens and identified all questionable species. The difficulty in separating certain immature species and nomenclature ambiguities of others was resolved by combining the species in question. Frequent lack of flowers or mature fruit required treating both *Osmorhiza chilensis* and *Osmorhiza depauperata* as *O. chilensis*, and *Rosa woodsii* and *Rosa nutkana* as *R. woodsii*. Other species, though separately identified in the field, were combined in the summaries for convenience because of their similarities. These are: *Sambucus racemosa* and *Sambucus cerulea* as *S. racemosa; Festuca idahoensis* and *Festuca ovina* as *F. idahoensis; Delphinium occidentale* and *Delphinium barbeyi* as *D. occidentale; Fragaria vesca* and *Fragaria virginiana* as *F. vesca; Mertensia arizonica, Mertensia ciliata,* and *Mertensia franciscana* as *M. arizonica; Polemonium foliosissimum* and *Polemonium occidentale* as *P. foliosissimum*; and *Senecio serra* and *Senecio triangularis* as *S. serra*.

Nomenclature ambiguities forced a somewhat arbitrary selection of names for some species. Thus, the *Agropyron trachycaulum-Agropyron subsecundum-Agropyron caninum* complex is treated as *A.trachycaulum; Bromus* *marginatus* and *Bromus polyanthus* are included with *Bromus carinatus*; and *Stipa columbiana* and *Stipa nelsonii* are lumped with *Stipa occidentalis*.

The traditional name of *Koeleria cristata* is used to include *Koeleria nitida*. Considerable confusion revolved around the separation of *Geranium viscosissimum* and *Geranium fremontii*. This confusion is reflected by different floras in adjacent States that seldom treat both species and that may indicate that *G. fremontii* is synonymous with *G. viscosissimum*. I have arbitrarily chosen to call this uncertain, pink-flowered complex *G. viscosissimum*. In the listing of species composition by community types in appendix F, species names representing the above combinations are followed by "+."

All vegetation and environmental data were subsequently coded, entered into computer files, and then checked for errors. Before beginning the process of evaluating the data for determining community relationships, every tenth stand was deleted from the file to serve as an unbiased validation of the resulting classification and of the field key that would serve to assist in type identification. These validation stands were subsequently reintroduced into the data file for compilation of all tables summarizing the community type data.

Development of the classification relied principally on the use of synthesis or association tables (Mueller-Dombois and Ellenberg 1974). The synthesis table method permitted subjective recognition of similarities in vegetation structure and in species' fidelity, constancy, and coverage. Certain species appeared to be indicative of natural succession, environment, and grazing degradation. Other species strongly affected vegetation structure. Numerous reiterations of stand alignments permitted sequencing according to visual similarities of these important species. (Earlier attempts to classify the Idaho aspen stands by using cluster analysis of vegetation similarity indices failed to produce grouping sensible for management [Mueggler and Campbell 1982]. In the computation of similarity indices, the great variation in presence and cover of the many minor species apparently overshadowed the relatively few species that exert a dominant role as expressed by life form and amount of cover and that, I believe, should be stressed in the development of a meaningful classification.)

Stands were grouped into community types according to the constancy and abundance of the selected indicator species. Similarity of vegetation structure was a prime consideration in forming the groups. The presence or absence of substantial amounts of conifers in the overstory, or potentially so as judged by conifer regeneration, was the first separation criterion. These were categorized as aspen-conifer cover types. The presence of substantial amounts of conifers was considered highly relevant because of successional implications. In the normal course of succession, all such mixed cover types will probably succeed to coniferous forest climax communities. The presence of a tall shrub layer and of a low shrub layer were second and third criteria considered in grouping stands. These shrub layers not only tend to reflect environmental differences but are also highly relevant to management. Herbaceous layer indicator species are those considered to be sensitive indicators of abiotic environmental extremes and those sensitive to severe vegetational alterations caused by prolonged excessive grazing. Thus, species prevalence within the tree, shrub, and herb life form classes were used to delineate and characterize the aspen community types.

After grouping the stands into what appeared to be sensible community types, a dichotomous key based on characterizing species was prepared and then checked against all stands that were used to develop the classification. This key was developed to facilitate field use of the classification. The key was then used to classify the validation stands into community types; the species compositions of these were then compared to that of the original groups forming the classification and changes incorporated where necessary. Of the original stands used to develop the classification, 6 percent could not readily be placed into identifiable community types. Similarly, 6 percent of the validation stands did not fit the classification. These undetermined stands are likely either unusual isolated communities or represent ill-defined community types reflecting unusual environmental or disturbance situations.

Because the ability to judge the successional status of the aspen community types is important, I have attempted to clarify this status by linking the community types to coniferous forest habitat types previously identified in the Intermountain Region (Mauk and Henderson 1984; Steele and others 1983; Youngblood and Mauk 1985) and to climax aspen community types identified by the current study. An objective index to probable successional relationships was arrived at by comparing constancy values of species in obviously seral aspen types with those in coniferous forest habitat types. The premise was that species with high constancy in a climax type are more likely to have high constancy in a related successional stage of that type than they are in an unrelated stage. To reduce the level of "noise species," only those species that had at least 50 percent constancy in the given climax type (habitat type) were used in the comparisons. Furthermore, to increase the effect on the index of those species with high constancy (indicator species?) in the climax type, the values for species with 80 percent or greater constancy in the climax type were double-weighted. Sorensen's index of similarity (SI=2w/A+B) (Mueller-Dombois and Ellenberg 1974), where "0" indicates no relationship and "1" identical relationship, was used in these comparisons. These indices (appendix E) were computed for all successional and climax types that might be related. The linkages between aspen community types and coniferous forest habitat types, as discussed in the type descriptions, are based on these similarity indices combined with subjectively evaluating the composition of the vegetation characterizing the types, using knowledge of probable changes attributable to succession or grazing, and comparing environmental similarities where possible. At best, the linkages are only suggestive and will require intensive separate study for confirmation of the relationships.

Site index at 80 years was determined on each of the intensively sampled stands from curves developed by Edminster and others (1985) for the Central Rocky Mountains. An estimate of potential aspen volume productivity on each intensively sampled site was determined from site index using the relationship developed by Mowrer (1986); production was expressed as total volume increment per year at stand maturity. Site index and volume increment were summarized by community type and are shown in appendix I.

An approximation of undergrowth suitability as livestock forage was based on forage suitability ratings developed for Intermountain Region species by USDA Forest Service (1981). The proportion of total canopy cover composed of species in each of three suitability classes (desirable, intermediate, least) is considered an index to the value of the undergrowth as livestock forage. This was computed for each community type by summing the constancy times the cover data (appendix K) for each species within each suitability class and dividing by the summation of constancy times cover for all classes to give the relative percentage of vegetation within each class.

APPENDIX B: MAJOR (MA), MINOR (MI), AND INCIDENTAL (I) ASPEN COMMUNITY TYPES IN THE INTERMOUNTAIN REGION BY OVERSTORY COVER TYPES. THE COMMUNITY TYPE ACRONYM REFLECTS BOTH THE OVERSTORY AND UNDERGROWTH: KEY OVERSTORY SPECIES/SHRUB SPECIES/HERBACEOUS SPECIES

Undergrowth category			Overstory cover type							
Tall shrub	Low shrub	Herb	POTR	POTR-ABLA	POTR-PICO	POTR-PSME	POTR-ABCO	POTR-PIPU	POTR-PIFL	POTR-PIPO
(undetermined)								I	I	I
SASC	-	-	I							
AMAL	-	-		I		I				
AMAL	-	T.F.	MA							
AMAL	-	THFE	MI							
AMAL	-	PTAQ	I							
AMAL	SYOR	T.F.	MA							
AMAL	SYOR	THFE	MA							
AMAL	SYOR	CARU	MA							
AMAL	SYOR	BRCA	MI							
	SYOR	-			I	I	I			
	SYOR	T.F.	MA	MI						
	SYOR	THFE	MA	I						
	SYOR	CARU	MA							
	SYOR	CARO	I							
	SYOR	BRCA	MA	I						
	SYOR	POPR	MI							
	SYOR	FETH	I							
	SYOR	WYAM	I							
	JUCO	-		MI	MI	MI				
	JUCO	CAGE	MI							
	JUCO	LUAR	I							
	JUCO	ASMI	I							
	ARTR	-	MI							
	ARPA	-					I			
	SHCA	-	I	I						
	RUPA	-	I							
	SARA	-	I							
		T.F.	MA	MA						
		THFE	MA	MI	I					
		CARU	MA			I				
		CARO	MA	MA						
		CAGE		I	I					
		BRCA	MA							
		POPR	MI				I			
		FETH	I							
		STCO	I							
		ASMI	I							
		WYAM	MI							
		PTAQ	I							
		VECA	I							

APPENDIX C: PROPORTION OF ASPEN STANDS SAMPLED ON EACH NATIONAL FOREST THAT WAS CLASSIFIED IN VARIOUS TYPES

	National Forests											
Community types (No. of stands classified:)	Bridger-Teton (165)	Targhee (157)	Caribou (183)	Wasatch-Cache (387)	Ashley (114)	Uinta (236)	Manti-LaSal (138)	Fishlake (109)	Dixie (143)	Humboldt (324)	Toiyabe (57)	All Forests (2,013)
						Percent						
POTR/VECA	0	0	0	1	0	T[1]	0	0	0	1	0	T
POTR/PTAQ	0	0	0	2	0	2	0	0	1	0	0	1
POTR/WYAM	3	1	3	1	0	0	0	0	0	5	0	1
POTR/FETH	0	0	0	0	0	0	0	6	8	0	0	1
POTR/TALL FORB	15	1	5	14	1	21	15	6	2	18	0	11
POTR/CARU	12	18	10	1	7	2	4	2	0	0	0	4
POTR/THFE	18	4	1	3	1	1	7	2	1	8	0	5
POTR/BRCA	1	1	1	5	1	4	4	3	3	8	5	4
POTR/CARO	1	0	0	0	0	0	1	8	10	T	54	3
POTR/STCO	0	1	0	T	2	0	0	1	7	0	0	1
POTR/ASMI	1	0	0	1	2	0	0	2	2	0	0	1
POTR/POPR	0	0	1	1	4	0	3	2	3	1	0	1
POTR/RUPA	1	0	1	T	0	T	0	0	0	0	0	T
POTR/SARA	0	0	0	T	0	2	4	0	0	0	0	1
POTR/SHCA	4	1	2	0	0	0	0	0	0	0	0	1
POTR/SYOR/ TALL FORB	2	3	10	12	0	27	12	6	0	13	2	10
POTR/SYOR/CARU	7	17	11	T	5	4	9	0	0	T	0	4
POTR/SYOR/THFE	3	3	9	4	4	2	4	1	0	7	0	4
POTR/SYOR/FETH	0	0	0	0	0	0	0	3	3	0	0T	
POTR/SYOR/CARO	1	0	0	0	0	0	0	10	1	0	9	1
POTR/SYOR/WYAM	0	0	0	0	0	0	0	0	0	2	0	T
POTR/SYOR/BRCA	0	0	1	4	8	3	4	4	1	4	16	3
POTR/SYOR/POPR	0	0	0	2	1	1	8	1	7	T	0	2
POTR/JUCO/CAGE	0	0	1	T	18	0	0	1	0	0	0	1
POTR/JUCO/LUAR	1	0	0	1	5	0	0	4	0	0	0	1
POTR/JUCO/ASMI	0	0	0	2	4	0	0	0	1	0	0	1
POTR/ARTR	2	0	0	3	3	1	0	1	0	1	12	1
POTR/SASC	0	1	0	1	0	0	0	0	0	3	0	1
POTR/AMAL-SYOR/ TALL FORB	1	4	7	10	0	7	2	1	0	5	2	5
POTR/AMAL-SYOR/ THFE	1	5	6	2	1	3	0	1	0	2	0	2
POTR/AMAL-SYOR/ CARU	2	22	15	1	0	T	0	0	0	0	0	3
POTR/AMAL-SYOR/ BRCA	0	1	1	2	1	3	1	0	0	0	0	1
POTR/AMAL/PTAQ	0	0	0	1	1	1	0	0	1	0	0	1
POTR/AMAL/TALL FORB	0	2	1	2	0	2	0	0	0	7	0	2
POTR/AMAL/THFE	0	1	2	2	2	0	0	0	0	2	0	1
POTR-ABLA/SHCA	5	0	1	T	0	0	0	0	0	0	0	1
POTR-ABLA/AMAL	0	0	1	2	0	T	1	0	0	0	0	T
POTR-ABLA/SYOR/ TALL FORB	1	0	1	3	1	2	1	1	0	0	0	1
POTR-ABLA/SYOR/ THFE	1	0	2	1	1	T	1	1	1	T	0	1
POTR-ABLA/SYOR/ BRCA	0	0	0	1	3	T	1	0	1	0	0	1
POTR-ABLA/JUCO	0	0	0									
POTR-ABLA/TAL	0	2	3	0	2	3	1	1	1	0	2	
POTR-ABLA/CAGE	1	0	1	1	3	0	4	0	0	0	0	1
POTR-ABLA/CARO	0	0	0	0	0	0	0	12	20	1	0	2
POTR-PICO/SYOR	0	3	3	1	2	0	0	0	0	0	0	1
POTR-PICO/JUCO	1	0	0	3	8	0	0	0	0	0	0	1

(con.)

APPENDIX C (Con.)

	National Forests											
Community types (No. of stands classified:)	Bridger-Teton (165)	Targhee (157)	Caribou (183)	Wasatch-Cache (387)	Ashley (114)	Uinta (236)	Manti-LaSal (138)	Fishlake (109)	Dixie (143)	Humboldt (324)	Toiyabe (57)	All Forests (2,013)
	Percent											
POTR-PICO/THFE	0	0	0	2	1	0	0	0	0	0	0	T
POTR-PICO/CAGE	0	4	0	2	4	T	0	0	0	0	0	1
POTR-PSME/AMAL	1	4	2	1	0	1	1	0	0	0	0	1
POTR-PSME/SYOR	1	1	3	1	1	T	0	0	1	0	0	1
POTR-PSME/JUCO	0	0	0	0	4	0	0	4	2	T	0	1
POTR-PSME/CARU	2	2	0	0	0	0	0	0	0	0	0	T
POTR-ABCO/SYOR	0	0	0	0	0	3	5	6	1	3	0	2
POTR-ABCO/ARPA	0	0	0	0	0	0	0	0	0	2	0	1
POTR-ABCO/POPR	0	0	0	0	0	0	0	1	2	2	0	1
POTR-PIPU	0	0	0	0	3	0	1	4	4	0	0	1
POTR-PIFL	1	0	0	0	0	0	0	1	1	2	0	T
POTR-PIPO	0	0	0	0	3	0	2	0	8	0	0	1

[1] T = less than 0.5 percent.

APPENDIX D: RELATIONSHIP OF THE PREVIOUS ASPEN CLASSIFICATIONS FOR PARTS OF THE INTERMOUNTAIN REGION TO THE CURRENT COMPREHENSIVE CLASSIFICATION THAT SUPERCEDES THEM

Intermountain Region aspen classification	Utah classification (Mueggler and Campbell 1986)	Caribou and Targhee classification (Mueggler and Campbell 1982)	Bridger-Teton classification (Youngblood and Mueggler 1981)
MAJOR COMMUNITY TYPES:			
POTR/TALL FORB	POTR/SESE POTR/HELA	POTR/RUOC	POTR/RUOC POTR/HELA POTR/LIFI
POTR/SYOR/TALL FORB	POTR/SYOR/SESE	POTR/SYOR-RUOC	POTR/SYOR (in part)
POTR/AMAL-SYOR/TALL FORB	POTR/PRVI/SESE (major part)	POTR/AMAL-SYOR (minor part)	
POTR-ABLA/TALL FORB	POTR-ABLA/SESE		POTR-ABLA/RUOC POTR-ABLA/LIFI POTR-ABLA/ARCO (minor part)
POTR/CARU	POTR/CAGE (in part) POTR/CARU-POPR	POTR/CARU	POTR/CARU
POTR/SYOR/CARU	POTR/SYOR/CAGE (in part)	POTR/SYOR-CARU POTR/PAMY-CARU POTR/SPBE-CARU	POTR/SPBE (minor part)
POTR/AMAL-SYOR/CARU	POTR/PRVI/CAGE (major part)	POTR/AMAL-SYOR (major part) POTR/AMAL-PAMY POTR/AMAL-SPBE	POTR/PRVI (major part) POTR/SPBE (major part)
POTR/THFE		POTR/GEVI POTR/POPR (major part)	POTR/THFE POTR/BERE (major part) POTR/ARCO (minor part) POTR/ASMI (minor part)
POTR/SYOR/THFE	POTR/SYOR/CAGE (minor part)	POTR/SYOR-POPR POTR/PAMY-GEVE	POTR/SYOR (in part) POTR/ARCO (in part) POTR/ASMI (in part)
POTR/AMAL-SYOR/THFE			
POTR/CARO	POTR/CAGE (minor part)		
POTR-ABLA/CARO	POTR-ABLA/CAGE (major part)		
POTR/BRCA	POTR/BRCA	POTR/POPR (minor part)	
POTR/SYOR/BRCA	POTR/SYOR/BRCA		
MINOR COMMUNITY TYPES:			
POTR/WYAM		POTR/WYAM	POTR/WYAM
POTR/ARTR	POTR/JUCO/SIHY (in part)	POTR/ARTR-FEID	POTR/ARTR
POTR/JUCO/CAGE	POTR/JUCO/CAGE (major part)		
POTR/POPR	POTR/POPR	POTR/POPR (minor part)	
POTR/SYOR/POPR	POTR/SYOR/POPR	POTR/SYOR-POPR	
POTR/AMAL/THFE	POTR/PRVI/CAGE (minor part)	POTR/AMAL-CARU (major part)	POTR/PRVI (minor part)
POTR/AMAL/TALL FORB	POTR/PRVI/SESE (minor part)	POTR/AMAL-CARU (minor part)	
POTR/AMAL-SYOR/BRCA			
POTR-ABLA/SYOR/TALL FORB	POTR-ABLA/SYOR/SESE	POTR-ABLA/SYOR (in part)	
POTR-ABLA/THFE		POTR-ABLA/THFE	POTR-ABLA/ARCO (in part) POTR-ABLA/BERE (in part)
POTR-PICO/JUCO	POTR-PICO/JUCO		
POTR-ABCO/SYOR	POTR-ABCO/SYOR		

(con.)

APPENDIX D (Con.)

Intermountain Region aspen classification	Utah classification (Mueggler and Campbell 1986)	Caribou and Targhee classification (Mueggler and Campbell 1982)	Bridger-Teton classification (Youngblood and Mueggler 1981)
INCIDENTAL COMMUNITY TYPES:			
POTR/VECA	POTR/VECA		
POTR/RUPA			
POTR/SARA	POTR/SARA		
POTR/SASC			
POTR/PTAQ	POTR/PTAQ		
POTR/AMAL/PTAQ	POTR/ACGR/PTAQ		
POTR/FETH	POTR/FETH		
POTR/SYOR/FETH	POTR/SYOR/FETH		
POTR/SYOR/CARO	POTR/SYOR/CAGE (minor part)		
POTR/SYOR/WYAM			
POTR/ASMI	POTR/CAGE (minor part) POTR/JUCO/ASMI (in part)		POTR/ASMI (minor part)
POTR/JUCO/ASMI	POTR/JUCO/ASMI (in part) POTR/JUCO/CAGE (minor part)		
POTR/JUCO/LUAR	POTR/JUCO/SIHY (in part) POTR/JUCO/CAGE (minor part)		
POTR/STCO	POTR/SIHY		
POTR/SHCA			POTR/SHCA POTR/JUCO
POTR-ABLA/SHCA			POTR-ABLA/SHCA POTR-ABLA/BERE (in part)
POTR-ABLA/AMAL	POTR-ABLA/AMAL		POTR-ABLA/PRVI
POTR-ABLA/SYOR/BRCA			
POTR-ABLA/SYOR/THFE	POTR-ABLA/SYOR/CAGE (major part)	POTR-ABLA/SYOR (in part)	POTR-ABLA/BERE (in part)
POTR-ABLA/JUCO	POTR-ABLA/JUCO		
POTR-ABLA/CAGE	POTR-ABLA/CAGE (minor part)		
POTR-PICO/SYOR		POTR-PICO/CARU (in part)	
POTR-PICO/THFE			
POTR-PICO/CAGE	POTR-PICO/VASC	POTR-PICO/CARU (in part)	
POTR-PSME/AMAL	POTR-PSME/AMAL	POTR-PSME/AMAL	POTR-PSME/SPBE
POTR-PSME/SYOR		POTR-PSME/SYOR	POTR-PSME/CARU (minor part)
POTR-PSME/JUCO	POTR-PSME/JUCO		
POTR-PSME/CARU		POTR-PSME/CARU	POTR-PSME/CARU (major part)
POTR-ABCO/POPR	POTR-ABCO/JUCO		
POTR-ABCO/ARPA			
POTR-PIPU			
POTR-PIFL			
POTR-PIPO	POTR-PIPO/QUGA POTR-PIPO/JUCO		

APPENDIX E1: SIMILARITY INDICES[1] BETWEEN SERAL ASPEN C.T.'S IN THE POTR-ABLA COVER TYPE AND *ABIES LASIOCARPA* HABITAT TYPES IN THE INTERMOUNTAIN REGION

Habitat types in ABLA series	Seral aspen community types								
	POTR-ABLA/SHCA	POTR-ABLA/AMAL	POTR-ABLA/SYOR/TALL FORB	POTR-ABLA/SYOR/THFE	POTR-ABLA/JUCO	POTR-ABLA/TALL FORB	POTR-ABLA/THFE	POTR-ABLA/CAGE	POTR-ABLA/CARO
Idaho and western Wyoming[2]									
ABLA/ARLA	0.64	NA	0.44	0.53	NA	0.48	0.56	0.43	NA
ABLA/SYAL	.76	NA	.52	.66	NA	.35	.57	.55	NA
ABLA/THOC	.87	NA	.57	.73	NA	.62	.65	.66	NA
ABLA/OSCH	.83	NA	.68	.74	NA	.67	.75	.67	NA
ABLA/CARU	.76	NA	.47	.60	NA	.45	.54	.64	NA
ABLA/CARO	.75	NA	.48	.69	NA	.65	.73	.55	NA
ABLA/BERE	.85	NA	.57	.73	NA	.50	.66	.62	NA
ABLA/ARCO	.77	NA	.50	.65	NA	.54	.65	.55	NA
Northern Utah[3]									
ABLA/OSCH	NA	0.85	.85	.82	0.49	.88	.84	.76	NA
ABLA/CARU	NA	.61	.43	.67	.35	.36	.57	.62	NA
ABLA/BERE	NA	.84	.74	.84	.51	.56	.69	.72	NA
ABLA/ACGL	NA	.72	.63	.68	.38	.53	.64	.63	NA
ABLA/VACA	NA	.29	.31	.39	.50	.30	.46	.40	NA
ABLA/PERA	NA	.56	.45	.56	.32	.43	.60	.39	NA
ABLA/RIMO	NA	.51	.56	.49	.23	.62	.54	.33	NA
ABLA/JUCO	NA	NA	NA	NA	.61	NA	NA	.33	NA
Southern Utah[4]									
ABLA/CAGE	NA	NA	.63	.75	.51	.62	.69	.81	0.38
ABLA/CARO	NA	NA	.41	.59	.75	.43	.65	.59	.83
ABLA/BERE	NA	NA	.63	.81	.68	.46	.68	.73	.57
ABLA/ACGL	NA	NA	.60	.71	.42	.41	.61	.63	.29
ABLA/VACA	NA	NA	.45	.56	.27	.52	.61	.45	.24
ABLA/RIMO	NA	NA	.46	.54	.45	.63	.59	.42	.39
ABLA/JUCO	NA	NA	.22	.46	.90	.14	.43	.38	.73

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[1] Sorensen's index (SI= 2w/A+B) (Mueller-Dombois and Ellenberg 1974) based on constancy comparisons of only those species with 50 percent or greater constancy in the conifer habitat type. Values for species with 80 percent or greater constancy in the habitat type are double weighted.

[2] From Steele and others (1983).

[3] From Mauk and Henderson (1984).

[4] From Youngblood and Mauk (1985).

APPENDIX E2: SIMILARITY INDICES[1] BETWEEN SERAL ASPEN C.T.'S IN THE POTR-PICO, POTR-PSME, AND POTR-ABCO COVER TYPES, AND CONIFEROUS FOREST TYPES PREVIOUSLY IDENTIFIED IN THE INTERMOUNTAIN REGION

	Seral aspen community types									
Coniferous forest types	POTR-PICO/CAGE	POTR-PICO/SYOR	POTR-PICO JUCO	POTR-PICO/THFE	POTR-PSME/CARU	POTR-PSME/AMAL	POTR-PSME/SYOR	POTR-PSME/JUCO	POTR-ABCO/SYOR	POTR-ABCO/ARPA
Idaho and western Wyoming[2]										
ABLA/CARU	0.61	0.65	0.35	0.54	NA	NA	NA	NA	NA	NA
ABLA/ARLA	.53	.43	.48	.54	NA	NA	NA	NA	NA	NA
ABLA/OSCH	.57	.65	.49	.74	NA	NA	NA	NA	NA	NA
ABLA/THOC	.64	.79	.49	.74	NA	NA	NA	NA	NA	NA
ABLA/BERE	.61	.64	.58	.74	NA	NA	NA	NA	NA	NA
ABLA/ARCO	.63	.56	.37	.61	NA	NA	NA	NA	NA	NA
PSME/BERE	.58	.67	.48	.72	0.65	0.79	0.69	0.55	NA	NA
PSME/OSCH	.64	.74	.51	.68	.73	.87	.78	.57	NA	NA
PSME/SYAL	.54	.61	.50	.64	.57	.81	.71	.67	NA	NA
PSME/CARU	.77	.79	.66	.69	.90	.76	.78	.47	NA	NA
PSME/ACGL	.53	.64	.42	.62	.59	.78	.64	.49	NA	NA
Northern Utah[3]										
ABLA/CARU	.65	.68	.45	.70	NA	NA	NA	NA	NA	NA
ABLA/OSCH	.63	.75	.53	.81	NA	NA	NA	NA	NA	NA
ABLA/BERE	.57	.63	.49	.85	NA	NA	NA	NA	NA	NA
PICO/VACA	.50	.41	.52	.64	NA	NA	NA	NA	NA	NA
PICO/VASC	.49	.46	.46	.60	NA	NA	NA	NA	NA	NA
PICO/JUCO	.53	.39	.62	.69	NA	NA	NA	NA	NA	NA
PICO/ARUV	.58	.38	.67	.58	NA	NA	NA	NA	NA	NA
PICO/BERE	.69	.55	.72	.72	NA	NA	NA	NA	NA	NA
PICO/CARO	.56	.51	.48	.56	NA	NA	NA	NA	NA	NA
PSME/BERE	.62	.70	.56	.78	.69	.81	.73	.66	NA	NA
PSME/OSCH	.57	.70	.41	.72	.67	.85	.73	.43	NA	NA
PSME/SYOR	.46	.50	.67	.46	.24	.35	.44	.78	NA	NA
PSME/ACGL	.47	.59	.41	.47	.53	.76	.63	.46	NA	NA
ABCO/BERE	NA	NA	NA	NA	NA	NA	NA	NA	0.78	0.54
ABCO/OSCH	NA	NA	NA	NA	NA	NA	NA	NA	.57	.34
Southern Utah[4]										
PSME/BERE	NA	NA	NA	NA	NA	.74	.73	.90	NA	NA
PSME/SYOR	NA	NA	NA	NA	NA	.49	.61	.80	NA	NA
ABCO/BERE	NA	NA	NA	NA	NA	NA	NA	NA	.77	.62
ABCO/SYOR	NA	NA	NA	NA	NA	NA	NA	NA	.67	.75
ABCO/ARPA	NA	NA	NA	NA	NA	NA	NA	NA	.54	.82

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[1] Sorensen's index (SI= 2w/A+B) (Mueller-Dombois and Ellenberg 1974) based on constancy comparisons of only those species with 50 percent or greater constancy in the conifer habitat type. Values for species with 80 percent or greater constancy in the habitat type are double weighted.

[2] From Steele and others (1983).

[3] From Mauk and Henderson (1984).

[4] From Youngblood and Mauk (1985).

APPENDIX F: CONSTANCY AND AVERAGE CANOPY COVER (LATTER IN PARENTHESES) OF IMPORTANT PLANT SPECIES IN THE ASPEN COMMUNITY TYPES OF THE INTERMOUNTAIN REGION

	POTR/ VECA	POTR/ PTAQ	POTR/ WYAM	POTR/ FETH	POTR/ TALL FORBS	POTR/ CARU	POTR/ THFE	POTR/ BRCA	POTR/ CARO	POTR/ STCO	POTR/ ASMI
Number of Stands:	7	13	30	18	228	90	92	77	57	16	11
TREES											
ABIES CONCOLOR	-(-)	-(-)	-(-)	11(T)	3(3)	1(T)	3(1)	12(1)	2(5)	-(-)	-(-)
ABIES LASIOCARPA	14(T)	8(1)	17(1)	39(2)	32(2)	29(1)	32(3)	26(4)	26(4)	19(2)	18(T)
PICEA ENGELMANNII	-(-)	-(-)	-(-)	33(3)	7(1)	10(1)	11(T)	5(1)	14(3)	25(T)	36(3)
PICEA PUNGENS	-(-)	-(-)	-(-)	-(-)	+(T)	-(-)	4(4)	1(T)	-(-)	-(-)	-(-)
PINUS CONTORTA	14(T)	-(-)	13(T)	-(-)	3(3)	26(2)	12(3)	8(1)	2(T)	13(3)	9(5)
PINUS FLEXILIS	-(-)	8(2)	-(-)	-(-)	4(1)	13(1)	20(1)	18(1)	33(1)	6(T)	27(1)
PINUS PONDEROSA	-(-)	-(-)	-(-)	6(T)	-(-)	-(-)	1(3)	-(-)	4(2)	31(3)	-(-)
POPULUS TREMULOIDES	100(61)	100(74)	100(69)	100(74)	100(73)	100(79)	100(72)	100(74)	100(74)	94(73)	100(80)
POPULUS TREMULOIDES (reprod.)	86(4)	77(12)	77(4)	94(3)	81(6)	74(5)	63(5)	87(5)	88(4)	88(13)	82(12)
PSEUDOTSUGA MENZIESII	-(-)	8(1)	13(T)	-(-)	5(2)	31(2)	11(2)	8(1)	9(1)	25(1)	9(T)
SHRUBS											
ACER GLABRUM	-(-)	8(2)	-(-)	-(-)	1(5)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
ACER GRANDIDENTATUM	14(T)	23(5)	3(T)	-(-)	5(2)	3(T)	1(T)	3(T)	-(-)	-(-)	-(-)
AMELANCHIER ALNIFOLIA	-(-)	23(T)	50(4)	-(-)	15(1)	31(1)	17(1)	12(1)	-(-)	6(T)	18(2)
ARCTOSTAPHYLOS UVA-URSI	-(-)	-(-)	3(1)	-(-)	-(-)	4(8)	4(10)	-(-)	-(-)	-(-)	9(3)
ARTEMISIA TRIDENTATA	-(-)	-(-)	10(2)	-(-)	6(T)	8(1)	4(1)	9(2)	42(3)	31(3)	9(2)
BERBERIS REPENS	14(T)	-(-)	7(1)	-(-)	10(5)	43(5)	39(9)	23(1)	18(2)	38(2)	27(10)
CEANOTHUS VELUTINUS	-(-)	-(-)	-(-)	-(-)	-(-)	2(12)	1(3)	1(T)	-(-)	-(-)	-(-)
CERCOCARPUS LEDIFOLIUS	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	1(5)	-(-)	-(-)	6(T)	-(-)
CHRYSOTHAMNUS VISCIDIFLORUS	-(-)	-(-)	-(-)	-(-)	+(1)	-(-)	1(T)	3(T)	16(T)	-(-)	-(-)
JUNIPERUS COMMUNIS	-(-)	8(T)	-(-)	11(4)	+(1)	18(2)	9(3)	5(2)	23(2)	50(3)	64(2)
LONICERA INVOLUCRATA	-(-)	-(-)	-(-)	-(-)	1(1)	2(1)	2(T)	-(-)	-(-)	-(-)	9(T)
PACHISTIMA MYRSINITES	-(-)	-(-)	-(-)	-(-)	2(2)	11(1)	8(1)	5(T)	-(-)	-(-)	-(-)
PHYSOCARPUS MALVACEUS	-(-)	-(-)	-(-)	-(-)	1(T)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
PRUNUS VIRGINIANA	14(T)	-(-)	7(3)	-(-)	9(2)	13(1)	7(2)	4(1)	-(-)	-(-)	-(-)
QUERCUS GAMBELII	-(-)	-(-)	-(-)	-(-)	+(2)	-(-)	-(-)	-(-)	2(T)	-(-)	-(-)
RIBES CEREUM	14(T)	-(-)	13(T)	-(-)	7(1)	1(T)	7(2)	3(T)	7(T)	-(-)	-(-)
RIBES INERME	-(-)	-(-)	-(-)	-(-)	2(2)	1(T)	2(T)	3(2)	-(-)	-(-)	-(-)
RIBES LACUSTRE	-(-)	-(-)	-(-)	6(2)	2(2)	1(T)	1(T)	3(2)	2(T)	-(-)	-(-)
RIBES MONTIGENUM	-(-)	-(-)	-(-)	-(-)	5(2)	3(1)	4(3)	6(T)	2(1)	-(-)	-(-)
RIBES VISCOSISSIMUM	-(-)	-(-)	-(-)	-(-)	1(T)	1(T)	-(-)	3(T)	-(-)	-(-)	-(-)
ROSA WOODSII +	29(T)	8(T)	20(1)	44(1)	12(1)	42(1)	34(1)	19(1)	25(1)	31(1)	73(6)
RUBUS PARVIFLORUS	-(-)	8(2)	-(-)	-(-)	1(2)	-(-)	-(-)	3(T)	-(-)	-(-)	-(-)
SALIX SCOULERIANA	29(2)	8(5)	3(T)	-(-)	3(1)	-(-)	2(3)	1(5)	-(-)	-(-)	-(-)
SAMBUCUS RACEMOSA +	14(T)	54(1)	-(-)	-(-)	29(2)	-(-)	5(1)	13(1)	2(T)	-(-)	-(-)
SHEPHERDIA CANADENSIS	-(-)	-(-)	7(2)	-(-)	3(2)	8(1)	17(1)	4(1)	-(-)	-(-)	-(-)
SORBUS SCOPULINA	-(-)	-(-)	-(-)	-(-)	1(2)	2(4)	1(T)	1(T)	-(-)	-(-)	-(-)
SPIRAEA BETULIFOLIA	-(-)	-(-)	-(-)	-(-)	-(-)	1(2)	-(-)	-(-)	-(-)	-(-)	-(-)
SYMPHORICARPOS ALBUS	-(-)	-(-)	-(-)	-(-)	1(2)	8(3)	1(T)	-(-)	-(-)	-(-)	-(-)
SYMPHORICARPOS OREOPHILUS	43(2)	46(1)	77(2)	72(2)	62(3)	60(2)	65(2)	60(2)	61(2)	31(1)	45(4)
VACCINIUM CAESPITOSUM	-(-)	-(-)	-(-)	-(-)	-(-)	1(T)	-(-)	1(T)	-(-)	-(-)	-(-)
GRAMINOIDS											
AGROPYRON TRACHYCAULUM +	43(8)	23(3)	60(4)	61(1)	50(4)	60(2)	51(5)	86(12)	56(5)	38(1)	36(3)
BROMUS ANOMALUS	-(-)	-(-)	-(-)	28(3)	1(10)	3(T)	-(-)	6(2)	51(10)	6(T)	9(5)
BROMUS CARINATUS +	57(8)	69(6)	73(3)	22(23)	76(12)	40(2)	53(7)	75(24)	11(5)	-(-)	9(T)
BROMUS CILIATUS	-(-)	8(4)	3(T)	11(3)	6(4)	24(4)	23(2)	5(T)	11(10)	19(3)	45(1)
CALAMAGROSTIS RUBESCENS	-(-)	-(-)	17(6)	-(-)	4(6)	73(47)	4(1)	-(-)	-(-)	-(-)	-(-)
CAREX GEYERI	-(-)	-(-)	3(20)	6(T)	4(2)	40(31)	8(2)	12(2)	-(-)	6(T)	18(2)
CAREX HOODII	43(3)	8(T)	27(2)	11(T)	25(4)	11(1)	23(2)	21(7)	2(3)	-(-)	-(-)
CAREX ROSSII	-(-)	15(2)	7(T)	28(2)	5(1)	-(-)	15(1)	6(1)	96(13)	19(2)	36(2)
DACTYLIS GLOMERATA	14(3)	-(-)	7(2)	-(-)	4(4)	7(T)	5(T)	8(14)	-(-)	-(-)	-(-)
ELYMUS CINEREUS	-(-)	-(-)	10(2)	-(-)	4(2)	3(1)	2(T)	1(7)	2(2)	-(-)	-(-)
ELYMUS GLAUCUS	29(4)	69(8)	37(8)	-(-)	42(13)	42(9)	40(7)	27(24)	2(T)	-(-)	-(-)
FESTUCA IDAHOENSIS +	-(-)	-(-)	23(1)	22(T)	2(1)	11(1)	22(1)	10(3)	14(2)	44(13)	27(2)
FESTUCA THURBERI	-(-)	-(-)	-(-)	100(16)	-(-)	-(-)	-(-)	-(-)	4(T)	6(T)	-(-)
KOELERIA CRISTATA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	3(10)	4(T)	6(T)	9(10)
LEUCOPOA KINGII	-(-)	-(-)	-(-)	6(1)	1(1)	6(T)	3(7)	4(1)	18(3)	-(-)	18(1)
MELICA SPECTABILIS	14(2)	8(T)	33(1)	-(-)	33(2)	11(1)	28(4)	42(5)	2(3)	6(T)	18(T)
PHLEUM ALPINUM	14(5)	-(-)	3(T)	-(-)	6(2)	10(7)	4(8)	8(3)	-(-)	-(-)	-(-)
PHLEUM PRATENSE	14(20)	-(-)	20(1)	-(-)	4(1)	19(3)	8(1)	1(10)	-(-)	-(-)	9(T)
POA AMPLA	-(-)	-(-)	3(T)	-(-)	4(7)	7(2)	18(1)	1(2)	5(1)	-(-)	-(-)
POA FENDLERIANA	-(-)	-(-)	-(-)	22(1)	1(T)	1(T)	7(3)	3(T)	32(2)	56(5)	27(1)
POA NERVOSA	14(T)	23(1)	10(2)	-(-)	32(2)	11(13)	35(6)	35(7)	11(4)	-(-)	18(1)
POA PALUSTRIS	-(-)	-(-)	7(3)	-(-)	1(1)	13(7)	5(17)	1(T)	-(-)	-(-)	-(-)
POA PRATENSIS	29(2)	15(4)	60(14)	39(5)	26(14)	46(14)	25(16)	43(29)	25(6)	19(4)	9(T)
SITANION HYSTRIX	-(-)	-(-)	-(-)	33(1)	-(-)	2(T)	-(-)	-(-)	28(1)	69(11)	27(1)
STIPA COMATA	-(-)	-(-)	-(-)	22(5)	-(-)	1(T)	-(-)	-(-)	2(T)	69(17)	-(-)
STIPA OCCIDENTALIS +	-(-)	8(T)	3(2)	67(2)	12(5)	22(7)	25(9)	29(7)	61(7)	38(4)	27(5)
TRISETUM SPICATUM	-(-)	-(-)	-(-)	28(T)	4(1)	11(1)	27(1)	17(T)	11(2)	13(T)	9(1)

(con.)

APPENDIX F (Con.)

	POTR/ VECA	POTR/ PTAQ	POTR/ WYAM	POTR/ FETH	POTR/ TALL FORBS	POTR/ CARU	POTR/ THFE	POTR/ BRCA	POTR/ CARO	POTR/ STCO	POTR/ ASMI
Number of Stands:	7	13	30	18	228	90	92	77	57	16	11
FORBS											
ACHILLEA MILLEFOLIUM	29(T)	15(2)	67(1)	72(4)	42(2)	74(1)	64(1)	66(3)	23(1)	31(3)	100(1)
ACONITUM COLUMBIANUM	-(-)	-(-)	-(-)	-(-)	2(5)	1(5)	1(20)	-(-)	-(-)	-(-)	-(-)
ACTAEA RUBRA	-(-)	31(9)	-(-)	-(-)	6(3)	-(-)	2(1)	3(T)	-(-)	-(-)	-(-)
AGASTACHE URTICIFOLIA	29(8)	62(7)	23(3)	11(3)	47(5)	3(1)	15(1)	22(1)	-(-)	-(-)	-(-)
AGOSERIS AURANTIACA	-(-)	-(-)	3(1)	-(-)	1(2)	3(T)	3(T)	4(T)	4(T)	6(T)	-(-)
AGOSERIS GLAUCA	-(-)	-(-)	7(1)	6(T)	6(T)	8(T)	8(T)	10(T)	14(T)	13(T)	9(T)
ALLIUM BREVISTYLUM	14(T)	-(-)	7(3)	-(-)	1(T)	1(T)	1(T)	1(T)	-(-)	-(-)	-(-)
ANGELICA PINNATA	14(2)	-(-)	-(-)	-(-)	3(T)	-(-)	4(5)	1(T)	-(-)	-(-)	-(-)
ANTENNARIA MICROPHYLLA	-(-)	-(-)	10(T)	17(T)	1(6)	18(1)	10(T)	4(T)	25(1)	44(3)	36(T)
APOCYNUM ANDROSAEMIFOLIUM	-(-)	-(-)	-(-)	-(-)	-(-)	1(3)	-(-)	3(1)	2(T)	-(-)	9(T)
AQUILEGIA COERULEA	-(-)	8(T)	-(-)	11(T)	13(1)	12(T)	11(2)	12(T)	2(T)	-(-)	9(5)
AQUILEGIA FORMOSA	29(T)	-(-)	17(3)	-(-)	15(3)	-(-)	3(4)	4(2)	-(-)	-(-)	-(-)
ARNICA CORDIFOLIA	-(-)	-(-)	7(2)	-(-)	6(5)	21(6)	14(13)	4(1)	2(T)	6(1)	9(T)
ARNICA LATIFOLIA	-(-)	-(-)	-(-)	-(-)	+(T)	1(10)	-(-)	-(-)	2(1)	-(-)	9(10)
ARTEMISIA LUDOVICIANA	-(-)	-(-)	-(-)	-(-)	2(2)	1(T)	9(3)	1(T)	2(T)	-(-)	-(-)
ASTER CHILENSIS	-(-)	-(-)	3(10)	-(-)	1(T)	-(-)	1(T)	5(T)	-(-)	-(-)	-(-)
ASTER ENGELMANNII	14(T)	62(2)	3(1)	-(-)	21(5)	14(3)	12(1)	13(1)	-(-)	-(-)	-(-)
ASTER FOLIACEUS	29(T)	-(-)	13(1)	-(-)	4(4)	14(1)	21(2)	3(20)	-(-)	-(-)	9(T)
ASTER PERELEGANS	-(-)	-(-)	23(1)	-(-)	3(T)	3(1)	11(1)	4(T)	-(-)	-(-)	9(1)
ASTRAGALUS MISER	-(-)	-(-)	7(2)	6(5)	3(5)	30(12)	17(15)	1(T)	18(8)	31(4)	100(30)
BALSAMORHIZA MACROPHYLLA	-(-)	-(-)	10(2)	-(-)	2(4)	1(T)	2(5)	1(T)	- J	-(-)	-(-)
BALSAMORHIZA SAGITTATA	-(-)	-(-)	7(3)	-(-)	3(3)	1(1)	3(2)	1(T)	-(-)	-(-)	-(-)
CALOCHORTUS NUTTALLII	-(-)	8(T)	3(T)	6(T)	+(T)	3(T)	-(-)	3(T)	5(T)	13(T)	-(-)
CAMPANULA ROTUNDIFOLIA	-(-)	-(-)	-(-)	-(-)	1(1)	17(T)	10(T)	-(-)	-(-)	-(-)	18(T)
CASTILLEJA LINARIAEFOLIA	-(-)	-(-)	-(-)	-(-)	-(-)	9(2)	1(T)	-(-)	-(-)	-(-)	-(-)
CASTILLEJA MINIATA	-(-)	8(T)	13(T)	11(T)	7(1)	10(1)	9(1)	9(1)	5(T)	6(2)	27(T)
CIRSIUM ARVENSE	-(-)	8(T)	3(T)	11(T)	1(T)	3(T)	2(T)	3(T)	-(-)	6(T)	-(-)
CIRSIUM VULGARE	14(T)	-(-)	-(-)	-(-)	+(T)	1(T)	1(T)	1(1)	-(-)	-(-)	-(-)
CLAYTONIA LANCEOLATA	14(T)	-(-)	3(2)	-(-)	3(2)	1(T)	3(1)	1(5)	-(-)	-(-)	-(-)
CORALLORHIZA MACULATA	-(-)	-(-)	13(T)	17(T)	3(T)	6(T)	5(T)	1(T)	5(T)	6(T)	9(T)
CREPIS ACUMINATA	-(-)	-(-)	3(T)	-(-)	1(1)	-(-)	-(-)	5(T)	2(T)	-(-)	9(T)
DELPHINIUM NUTTALLIANUM	-(-)	15(T)	17(T)	-(-)	18(T)	2(T)	4(T)	8(T)	-(-)	6(T)	-(-)
DELPHINIUM OCCIDENTALE +	29(T)	38(1)	13(1)	11(3)	32(5)	10(1)	11(1)	14(1)	-(-)	-(-)	-(-)
DISPORUM TRACHYCARPUM	-(-)	-(-)	-(-)	-(-)	-(-)	2(T)	-(-)	-(-)	-(-)	-(-)	-(-)
EPILOBIUM ANGUSTIFOLIUM	-(-)	-(-)	13(T)	11(1)	9(1)	20(3)	26(2)	3(1)	2(T)	-(-)	18(1)
EQUISETUM ARVENSE	-(-)	-(-)	-(-)	-(-)	+(4)	-(-)	2(5)	-(-)	-(-)	-(-)	-(-)
ERIGERON FLAGELLARIS	-(-)	8(1)	-(-)	-(-)	-(-)	1(T)	-(-)	-(-)	7(T)	-(-)	9(T)
ERIGERON PEREGRINUS	-(-)	-(-)	-(-)	-(-)	1(1)	3(1)	1(T)	1(1)	-(-)	6(T)	-(-)
ERIGERON SPECIOSUS	43(T)	8(1)	17(T)	6(T)	8(3)	8(1)	5(2)	12(T)	4(T)	6(1)	9(T)
FRAGARIA VESCA +	-(-)	8(T)	13(2)	22(2)	11(4)	50(2)	40(5)	12(2)	12(3)	6(15)	18(T)
FRASERA SPECIOSA	-(-)	-(-)	23(1)	-(-)	5(1)	21(1)	26(2)	4(2)	4(1)	-(-)	-(-)
FRITILLARIA ATROPURPUREA	-(-)	8(T)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	4(T)	6(T)	-(-)
GALIUM BOREALE	14(T)	23(3)	20(T)	-(-)	10(2)	37(1)	25(2)	6(2)	-(-)	6(T)	27(1)
GERANIUM RICHARDSONII	-(-)	15(3)	-(-)	6(18)	8(5)	2(2)	3(T)	1(10)	-(-)	-(-)	-(-)
GERANIUM VISCOSISSIMUM +	14(T)	-(-)	87(7)	6(T)	35(7)	80(8)	61(11)	21(2)	7(2)	19(2)	27(1)
HABENARIA UNALASCENSIS	-(-)	-(-)	10(T)	-(-)	2(T)	9(1)	-(-)	1(T)	-(-)	-(-)	-(-)
HACKELIA FLORIBUNDA	43(2)	46(1)	43(4)	-(-)	51(4)	11(3)	18(2)	27(1)	-(-)	-(-)	-(-)
HACKELIA PATENS	-(-)	-(-)	-(-)	-(-)	1(1)	-(-)	-(-)	1(T)	-(-)	-(-)	-(-)
HEDYSARUM BOREALE	-(-)	-(-)	7(6)	-(-)	2(2)	7(6)	15(5)	-(-)	2(1)	-(-)	9(T)
HELENIUM HOOPESII	14(T)	-(-)	-(-)	28(T)	5(2)	1(10)	8(2)	9(4)	5(T)	6(T)	9(2)
HELIANTHELLA UNIFLORA	-(-)	-(-)	23(4)	-(-)	6(10)	3(1)	5(2)	1(T)	-(-)	-(-)	-(-)
HERACLEUM LANATUM	-(-)	23(3)	-(-)	-(-)	12(15)	-(-)	2(T)	-(-)	-(-)	-(-)	-(-)
HIERACIUM ALBIFLORUM	-(-)	-(-)	-(-)	-(-)	+(T)	3(T)	1(T)	1(T)	-(-)	-(-)	-(-)
HIERACIUM CYNOGLOSSOIDES	-(-)	-(-)	-(-)	-(-)	1(T)	9(T)	3(T)	3(T)	-(-)	6(T)	-(-)
HYDROPHYLLUM CAPITATUM	43(2)	15(1)	7(1)	-(-)	28(2)	-(-)	14(2)	23(1)	-(-)	-(-)	-(-)
LATHYRUS LANSZWERTII	14(5)	38(17)	-(-)	39(31)	29(14)	9(23)	8(16)	26(26)	4(17)	6(4)	-(-)
LATHYRUS LEUCANTHUS	-(-)	8(10)	-(-)	28(36)	9(16)	6(32)	2(24)	10(11)	4(33)	-(-)	-(-)
LATHYRUS PAUCIFLORUS	14(5)	-(-)	-(-)	-(-)	4(1)	-(-)	8(1)	5(T)	-(-)	-(-)	-(-)
LIGUSTICUM FILICINUM	14(T)	-(-)	10(10)	-(-)	12(17)	6(8)	12(12)	3(T)	-(-)	-(-)	9(5)
LUPINUS ARGENTEUS	-(-)	-(-)	17(5)	6(T)	11(10)	61(7)	33(4)	8(4)	14(13)	50(19)	55(19)
LUPINUS CAUDATUS	-(-)	-(-)	10(1)	-(-)	1(5)	1(1)	3(1)	1(10)	-(-)	-(-)	-(-)
LUPINUS LAXIFLORUS	-(-)	-(-)	13(1)	-(-)	7(4)	-(-)	9(8)	17(7)	-(-)	-(-)	-(-)
LUPINUS SERICEUS	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	4(2)	51(6)	-(-)	-(-)
MERTENSIA ARIZONICA +	71(11)	15(1)	-(-)	11(3)	33(14)	2(5)	8(2)	10(2)	2(5)	-(-)	-(-)
MERTENSIA LONGIFLORA	-(-)	-(-)	-(-)	-(-)	1(24)	-(-)	1(3)	-(-)	-(-)	-(-)	-(-)
OSMORHIZA CHILENSIS +	29(3)	54(5)	27(9)	17(2)	44(5)	54(3)	50(5)	30(2)	2(4)	6(T)	18(T)
OSMORHIZA OCCIDENTALIS	14(T)	-(-)	27(8)	-(-)	53(11)	7(1)	14(2)	19(1)	-(-)	-(-)	-(-)
PAEONIA BROWNII	-(-)	-(-)	7(T)	-(-)	1(2)	-(-)	1(T)	-(-)	-(-)	-(-)	-(-)
PENSTEMON PROCERUS	-(-)	-(-)	-(-)	6(T)	+(T)	-(-)	5(4)	3(T)	-(-)	-(-)	9(1)
PENSTEMON WATSONI	-(-)	-(-)	7(2)	6(2)	2(2)	-(-)	8(1)	25(1)	11(1)	-(-)	-(-)

(con.)

	POTR/ VECA	POTR/ PTAQ	POTR/ WYAM	POTR/ FETH	POTR/ TALL FORBS	POTR/ CARU	POTR/ THFE	POTR/ BRCA	POTR/ CARO	POTR/ STCO	POTR/ ASMI
Number of Stands:	7	13	30	18	228	90	92	77	57	16	11
PERIDERIDIA GAIRDNERI	14(T)	-(-)	27(1)	-(-)	9(1)	37(1)	14(1)	6(3)	-(-)	6(T)	-(-)
PHACELIA HETEROPHYLLA	-(-)	31(1)	-(-)	-(-)	11(1)	1(T)	2(T)	8(7)	-(-)	6(T)	-(-)
POLEMONIUM FOLIOSISSIMUM +	-(-)	31(1)	-(-)	-(-)	25(3)	1(1)	10(2)	9(T)	-(-)	-(-)	-(-)
POTENTILLA DIVERSIFOLIA	-(-)	-(-)	-(-)	17(T)	-(-)	-(-)	-(-)	-(-)	5(T)	6(2)	-(-)
POTENTILLA GLANDULOSA	-(-)	8(T)	23(1)	22(T)	16(1)	44(1)	24(1)	10(1)	-(-)	19(2)	18(T)
POTENTILLA GRACILIS	-(-)	-(-)	27(2)	44(T)	12(1)	29(2)	32(1)	17(1)	5(T)	19(T)	27(T)
PTERIDIUM AQUILINUM	-(-)	100(56)	-(-)	-(-)	+(T)	1(5)	-(-)	-(-)	-(-)	-(-)	-(-)
RANUNCULUS INAMOENUS	-(-)	-(-)	-(-)	6(T)	3(3)	4(T)	5(T)	10(1)	4(T)	-(-)	-(-)
RUDBECKIA OCCIDENTALIS	43(3)	92(9)	13(10)	-(-)	56(19)	6(4)	12(1)	25(1)	-(-)	-(-)	-(-)
SCROPHULARIA LANCEOLATA	14(T)	31(1)	-(-)	-(-)	14(2)	1(T)	-(-)	8(T)	-(-)	-(-)	-(-)
SENECIO CRASSULUS	-(-)	-(-)	3(1)	6(T)	6(2)	4(2)	5(2)	3(T)	-(-)	6(4)	-(-)
SENECIO CYMBALARIOIDES	-(-)	8(T)	-(-)	-(-)	7(1)	6(T)	7(1)	12(1)	2(T)	-(-)	9(T)
SENECIO INTEGERRIMUS	-(-)	-(-)	13(1)	-(-)	3(1)	3(T)	5(1)	3(T)	14(T)	6(T)	-(-)
SENECIO SERRA +	29(30)	46(4)	50(6)	-(-)	49(5)	11(1)	18(1)	19(1)	-(-)	-(-)	-(-)
SENECIO STREPTANTHIFOLIUS	-(-)	-(-)	-(-)	-(-)	+(T)	4(T)	4(T)	-(-)	-(-)	-(-)	9(T)
SIDALCEA OREGANA	14(3)	-(-)	13(T)	-(-)	2(3)	-(-)	-(-)	3(1)	-(-)	-(-)	-(-)
SILENE MENZIESII	-(-)	8(T)	-(-)	6(T)	5(1)	6(1)	7(2)	8(1)	2(T)	6(T)	9(T)
SMILACINA RACEMOSA	-(-)	8(T)	17(1)	-(-)	8(2)	10(1)	3(3)	3(3)	-(-)	-(-)	-(-)
SMILACINA STELLATA	29(2)	33(14)	-(-)	11(T)	12(3)	28(1)	25(2)	6(4)	2(T)	-(-)	9(T)
STELLARIA JAMESIANA	71(3)	38(2)	40(1)	22(3)	61(3)	16(4)	28(3)	66(4)	51(1)	6(T)	-(-)
TARAXACUM OFFICINALE	29(5)	8(T)	67(4)	78(8)	36(2)	57(3)	51(2)	51(6)	51(4)	88(3)	64(2)
THALICTRUM FENDLERI +	29(4)	46(4)	37(6)	6(4)	61(12)	52(8)	76(18)	45(3)	14(1)	13(T)	27(1)
THERMOPSIS MONTANA	-(-)	-(-)	-(-)	-(-)	-(-)	1(T)	3(2)	1(T)	-(-)	-(-)	9(5)
TRAGOPOGON DUBIUS	14(T)	8(T)	7(T)	-(-)	4(T)	4(T)	5(T)	8(T)	4(T)	6(T)	-(-)
TRIFOLIUM GYMNOCARPON	-(-)	-(-)	3(T)	-(-)	-(-)	-(-)	1(T)	6(4)	2(20)	-(-)	-(-)
TRIFOLIUM LONGIPES	14(10)	-(-)	-(-)	6(T)	4(13)	4(3)	-(-)	9(4)	9(16)	19(10)	9(3)
URTICA DIOICA	14(10)	31(1)	-(-)	-(-)	4(1)	1(1)	2(T)	5(1)	-(-)	-(-)	-(-)
VALERIANA OCCIDENTALIS	57(4)	31(3)	20(2)	-(-)	59(7)	14(3)	17(3)	19(1)	-(-)	-(-)	-(-)
VERATRUM CALIFORNICUM	100(45)	-(-)	3(T)	-(-)	2(1)	1(T)	-(-)	1(T)	-(-)	-(-)	-(-)
VERBASCUM THAPSUS	-(-)	-(-)	-(-)	-(-)	1(T)	1(T)	2(T)	3(T)	-(-)	-(-)	-(-)
VICIA AMERICANA	29(4)	15(1)	-(-)	67(7)	24(7)	6(1)	10(1)	23(7)	4(11)	6(1)	-(-)
VIGUIERA MULTIFLORA	-(-)	8(T)	3(1)	6(T)	4(1)	1(1)	1(T)	8(T)	-(-)	-(-)	-(-)
VIOLA ADUNCA	-(-)	-(-)	7(T)	-(-)	7(1)	12(1)	17(1)	12(1)	4(1)	-(-)	9(T)
VIOLA NUTTALLII	-(-)	15(T)	23(6)	-(-)	26(3)	7(1)	20(2)	14(1)	2(T)	-(-)	-(-)
VIOLA PURPUREA	-(-)	-(-)	-(-)	-(-)	1(1)	-(-)	9(1)	3(1)	-(-)	-(-)	-(-)
WYETHIA AMPLEXICAULIS	14(5)	-(-)	100(40)	-(-)	5(1)	1(T)	4(T)	3(2)	-(-)	-(-)	-(-)
ANNUALS											
ANDROSACE SEPTENTRIONALIS	-(-)	-(-)	-(-)	-(-)	2(T)	2(2)	3(1)	9(T)	2(T)	6(T)	9(T)
CHENOPODIUM FREMONTII	-(-)	8(3)	-(-)	6(T)	8(2)	-(-)	2(T)	13(2)	2(T)	6(T)	-(-)
COLLINSIA PARVIFLORA	-(-)	15(4)	3(T)	-(-)	12(7)	4(1)	13(4)	21(4)	2(T)	-(-)	-(-)
COLLOMIA LINEARIS	-(-)	15(T)	10(4)	11(T)	27(4)	8(1)	14(3)	23(2)	4(T)	-(-)	-(-)
DESCURAINIA RICHARDSONII	14(T)	62(1)	13(T)	28(1)	44(1)	3(3)	14(1)	39(1)	12(T)	6(T)	-(-)
GALIUM APARINE	14(T)	-(-)	-(-)	-(-)	1(5)	-(-)	4(2)	-(-)	-(-)	-(-)	-(-)
GALIUM BIFOLIUM	14(15)	31(10)	33(6)	-(-)	32(5)	7(9)	17(5)	22(8)	2(1)	(T)	-(-)
MADIA GLOMERATA	-(-)	-(-)	-(-)	-(-)	1(T)	-(-)	-(-)	3(5)	-(-)	-(-)	-(-)
NEMOPHILA BREVIFLORA	71(15)	54(5)	37(14)	-(-)	48(24)	2(3)	12(29)	27(20)	-(-)	-(-)	-(-)
POLYGONUM DOUGLASII	-(-)	23(T)	3(T)	6(T)	20(6)	3(5)	13(3)	38(4)	7(T)	19(T)	-(-)

(con.)

APPENDIX F (Con.)

	POTR/ POPR	POTR/ RUPA	POTR/ SARA	POTR/ SHCA	POTR/ SYOR/ TALL FORB	POTR/ SYOR/ CARU	POTR/ SYOR/ THFE	POTR/ SYOR/ FETH	POTR/ SYOR/ CARO	POTR/ SYOR/ WYAM	POTR/ SYOR/ BRCA
Number of Stands:	20	4	11	11	205	88	79	7	18	6	66
TREES											
ABIES CONCOLOR	5(5)	-(-)	-(-)	-(-)	11(2)	1(T)	8(4)	14(T)	17(4)	-(-)	9(1)
ABIES LASIOCARPA	35(2)	25(6)	27(4)	64(T)	27(2)	31(1)	28(2)	14(5)	17(3)	-(-)	20(1)
PICEA ENGELMANNII	20(3)	25(T)	9(T)	55(2)	1(2)	3(2)	3(2)	14(T)	17(1)	-(-)	5(2)
PICEA PUNGENS	5(5)	-(-)	-(-)	-(-)	+(T)	2(1)	3(T)	-(-)	-(-)	-( )	2(T)
PINUS CONTORTA	5(4)	50(3)	-(-)	18(1)	2(1)	23(2)	11(2)	-(-)	-( )	-(-)	5(5)
PINUS FLEXILIS	20(1)	25(T)	-(-)	55(1)	1(4)	10(1)	10(1)	14(1)	-(-)	-(-)	6(T)
PINUS PONDEROSA	10(1)	-(-)	-( )	-(-)	-(-)	1(T)	-(-)	14(T)	6(T)	-(-)	2(1)
POPULUS TREMULOIDES	100(71)	100(60)	100(62)	100(70)	100(68)	100(74)	100(73)	100(72)	100(75)	100(63)	100(70)
POPULUS TREMULOIDES (reprod.)	90(5)	75(2)	73(2)	45(8)	87(5)	80(7)	87(5)	100(11)	89(7)	83(1)	71(8)
PSEUDOTSUGA MENZIESII	15(2)	25(1)	-(-)	18(2)	9(2)	33(1)	28(2)	43(3)	33(3)	-(-)	18(3)
SHRUBS											
ACER GLABRUM	-(-)	-(-)	-(-)	-(-)	1(1)	-(-)	4(2)	-(-)	-(-)	-(-)	-(-)
ACER GRANDIDENTATUM	-(-)	-(-)	-(-)	(-)	4(1)	3(T)	5(1)	-(-)	-(-)	-(-)	8(1)
AMELANCHIER ALNIFOLIA	25(1)	25(T)	-(-)	36(3)	31(2)	59(2)	42(2)	29(T)	6(T)	83(2)	30(1)
ARCTOSTAPHYLOS UVA-URSI	-(-)	-(-)	-(-)	18(10)	-(-)	1(1)	1(5)	-(-)	-(-)	-( )	2(3)
ARTEMISIA TRIDENTATA	15(1)	-(-)	-(-)	-(-)	5(1)	9(1)	11(1)	-(-)	22(1)	-(-)	26(2)
BERBERIS REPENS	30(3)	50(1)	-(-)	55(5)	17(2)	56(4)	42(6)	57(7)	17(7)	17(T)	38(7)
CEANOTHUS VELUTINUS	5(T)	25(8)	-(-)	-(-)	1(2)	7(5)	8(5)	-(-)	-(-)	-(-)	3(10)
CHRYSOTHAMNUS VISCIDIFLORUS	-(-)	-(-)	-(-)	-(-)	+(T)	1(20)	5(2)	-(-)	11(T)	17(1)	17(1)
JUNIPERUS COMMUNIS	50(2)	25(4)	-(-)	-(-)	+(T)	9(4)	11(3)	14(T)	22(4)	-(-)	12(4)
LONICERA INVOLUCRATA	-(-)	-(-)	-(-)	9(1)	+(T)	2(1)	1(T)	-(-)	-(-)	-(-)	-(-)
PACHISTIMA MYRSINITES	-(-)	75(16)	-(-)	36(48)	4(7)	26(18)	24(18)	-(-)	6(3)	-(-)	11(6)
PHYSOCARPUS MALVACEUS	-(-)	(-)	-(-)	-(-)	+(T)	1(5)	-(-)	-(-)	(-)	-(-)	-(-)
PRUNUS VIRGINIANA	5(1)	-(-)	9(5)	27(1)	28(2)	28(2)	20(2)	-(-)	-(-)	33(3)	11(1)
QUERCUS GAMBELII	10(1)	-(-)	-(-)	-(-)	1(T)	-(-)	1(5)	14(T)	-(-)	-(-)	2(5)
RIBES CEREUM	5(T)	25(T)	-(-)	9(1)	9(5)	1(T)	15(2)	-(-)	6(T)	67(8)	6(1)
RIBES INERME	10(1)	-(-)	-(-)	-(-)	4(1)	( )	-(-)	-(-)	-(-)	-(-)	6(1)
RIBES LACUSTRE	-(-)	-(-)	-(-)	-(-)	2(T)	-(-)	1(T)	-(-)	-(-)	-(-)	2(5)
RIBES MONTIGENUM	-(-)	-(-)	9(17)	-(-)	1(6)	-(-)	3(T)	-(-)	-(-)	-(-)	(-)
RIBES VISCOSISSIMUM	-(-)	-(-)	-(-)	9(T)	1(T)	3(T)	-(-)	-(-)	-(-)	-(-)	(-)
ROSA WOODSII +	35(2)	50(T)	-(-)	82(15)	29(2)	64(5)	43(5)	86(4)	50(1)	-(-)	41(1)
RUBUS PARVIFLORUS	-(-)	100(44)	-(-)	-(-)	+(T)	-(-)	1(T)	-(-)	-(-)	-(-)	-(-)
SALIX SCOULERIANA	-(-)	25(T)	-(-)	9(T)	1(2)	8(2)	3(4)	-(-)	-( )	-(-)	2(1)
SAMBUCUS RACEMOSA +	-(-)	-(-)	100(25)	-(-)	11(1)	2(T)	1(T)	14(T)	-(-)	-(-)	3(1)
SHEPHERDIA CANADENSIS	-(-)	75(2)	-(-)	100(30)	1(T)	7(2)	11(2)	-(-)	6(1)	-(-)	-(-)
SORBUS SCOPULINA	-(-)	25(T)	-(-)	-(-)	1(T)	2(1)	6(2)	-(-)	-(-)	-(-)	-(-)
SPIRAEA BETULIFOLIA	-(-)	-(-)	-(-)	-(-)	-(-)	9(13)	1(65)	-(-)	-(-)	-(-)	-(-)
SYMPHORICARPOS ALBUS	-(-)	-(-)	-(-)	-(-)	1(57)	28(24)	5(18)	(-)	-( )	-(-)	-( )
SYMPHORICARPOS OREOPHILUS	80(3)	50(T)	64(10)	73(8)	99(31)	74(22)	95(22)	100(31)	100(28)	100(25)	100(32)
GRAMINOIDS											
AGROPYRON SPICATUM	-(-)	-(-)	-(-)	-( )	( )	1(1)	-(-)	-(-)	-(-)	-(-)	2(T)
AGROPYRON TRACHYCAULUM +	55(3)	50(2)	73(1)	64(1)	59(5)	44(2)	66(4)	71(3)	56(2)	67(5)	83(8)
BROMUS ANOMALUS	10(3)	-(-)	-(-)	-(-)	-(-)	1(T)	-( )	71(7)	72(10)	-(-)	3(4)
BROMUS CARINATUS +	35(3)	25(1)	82(22)	9(T)	76(8)	19(1)	58(9)	(-)	28(1)	100(3)	70(12)
BROMUS CILIATUS	-(-)	25(T)	-(-)	45(19)	2(1)	17(2)	6(2)	14(3)	17(4)	(-)	9(3)
CALAMAGROSTIS RUBESCENS	5(2)	25(20)	-(-)	18(39)	3(20)	66(44)	9(3)	-(-)	(-)	-(-)	2(2)
CAREX GEYERI	15(3)	25(7)	-(-)	9(1)	5(12)	47(28)	9(1)	-(-)	(-)	-(-)	8(3)
CAREX HOODII	10(2)	-(-)	9(3)	18(3)	26(3)	8(1)	20(5)	-(-)	6(7)	33(T)	12(1)
CAREX ROSSII	10(T)	25(T)	-(-)	9(T)	2(T)	3(T)	9(1)	14(10)	72(7)	-(-)	14(2)
DACTYLIS GLOMERATA	25(T)	-(-)	-(-)	-(-)	9(3)	3(4)	5(T)	-( )	(-)	-( )	5(11)
ELYMUS CINEREUS	5(1)	-(-)	-(-)	-(-)	5(6)	5(2)	3(40)	-(-)	-(-)	-( )	6(1)
ELYMUS GLAUCUS	10(2)	50(2)	55(9)	36(6)	45(9)	52(7)	33(8)	-(-)	( )	50(T)	26(21)
FESTUCA IDAHOENSIS +	25(3)	-(-)	-(-)	9(T)	1(T)	6(1)	9(4)	(-)	28(T)	-( )	8(4)
FESTUCA THURBERI	-(-)	-(-)	-(-)	-(-)	-(-)	2(2)	-(-)	100(13)	6(1)	( )	(-)
HORDEUM JUBATUM	-(-)	25(T)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-( )	( )	(-)
KOELERIA CRISTATA	-(-)	-(-)	-(-)	-(-)	(-)	1(T)	-(-)	-(-)	6(T)	-(-)	-(-)
LEUCOPOA KINGII	-(-)	-(-)	-(-)	-(-)	-(-)	2(T)	-(-)	-(-)	-(-)	-(-)	2(1)
MELICA SPECTABILIS	15(2)	-(-)	18(1)	9(13)	19(1)	9(1)	22(5)	-(-)	6(T)	50(1)	18(6)
PHLEUM ALPINUM	-(-)	-(-)	-(-)	-(-)	4(1)	10(2)	1(T)	(-)	-( )	-(-)	(-)
PHLEUM PRATENSE	-(-)	-(-)	-(-)	9(6)	3(7)	2(T)	5(2)	-(-)	-(-)	-( )	-(-)
POA AMPLA	-(-)	-(-)	-(-)	18(1)	-(-)	1(2)	4(2)	-(-)	17(1)	-(-)	-(-)
POA FENDLERIANA	5(3)	-(-)	-(-)	18(T)	-(-)	1(T)	5(1)	14(3)	22(.)	-( )	6(4)
POA NERVOSA	10(6)	50(T)	27(3)	27(10)	17(2)	3(T)	13(10)	-( )	6(1)	-(-)	9(4)
POA PALUSTRIS	-(-)	-(-)	-(-)	9(5)	1(38)	3(1)	-(-)	-(-)	-(-)	-( )	( )
POA PRATENSIS	100(35)	-(-)	9(T)	27(14)	33(12)	42(9)	39(21)	14(10)	39(8)	33(3)	48(20)
SITANION HYSTRIX	10(T)	-(-)	-(-)	-(-)	-(-)	-(-)	-( )	-( )	28(1)	-(-)	3(T)
STIPA COMATA	10(2)	-(-)	-(-)	-(-)	-(-)	1(2)	1(T)	-(-)	-(-)	-(-)	2(3)
STIPA OCCIDENTALIS +	35(2)	-(-)	9(T)	-(-)	14(1)	20(4)	33(6)	71(3)	83(6)	33(1)	41(6)
TRISETUM SPICATUM	10(T)	50(1)	9(T)	27(1)	1(T)	3(T)	5(T)	-( )	-( )	( )	( )

(con.)

APPENDIX F (Con.)

	POTR/ POPR	POTR/ RUPA	POTR/ SARA	POTR/ SHCA	POTR/ SYOR/ TALL FORB	POTR/ SYOR/ CARU	POTR/ SYOR/ THFE	POTR/ SYOR/ FETH	POTR/ SYOR/ CARO	POTR/ SYOR/ WYAM	POTR/ SYOR/ BRCA
Number of Stands:	20	4	11	11	205	88	79	7	18	6	66
FORBS											
ACHILLEA MILLEFOLIUM	65(3)	25(2)	64(T)	55(2)	49(1)	67(1)	51(1)	86(T)	44(2)	33(2)	61(1)
ACONITUM COLUMBIANUM	-(-)	-(-)	-(-)	-(-)	1(T)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
ACTAEA RUBRA	-(-)	-(-)	27(1)	-(-)	3(T)	-(-)	-(-)	-(-)	-(-)	-(-)	2(10)
AGASTACHE URTICIFOLIA	-(-)	-(-)	45(9)	-(-)	74(5)	8(T)	15(1)	-(-)	6(T)	67(2)	29(1)
AGOSERIS AURANTIACA	5(T)	-(-)	-(-)	-(-)	2(T)	1(T)	-(-)	-(-)	-(-)	-(-)	2(T)
AGOSERIS GLAUCA	-(-)	-(-)	9(T)	-(-)	3(T)	7(T)	4(T)	-(-)	17(T)	33(1)	6(1)
ALLIUM BREVISTYLUM	-(-)	-(-)	-(-)	-(-)	6(T)	-(-)	3(T)	-(-)	-(-)	-(-)	-(-)
ANGELICA PINNATA	-(-)	-(-)	-(-)	-(-)	2(1)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
ANTENNARIA MICROPHYLLA	10(T)	25(T)	-(-)	9(T)	1(T)	8(3)	8(T)	-(-)	28(1)	-(-)	6(3)
APOCYNUM ANDROSAEMIFOLIUM	-(-)	-(-)	-(-)	-(-)	+(2)	6(5)	3(12)	-(-)	-(-)	-(-)	3(T)
AQUILEGIA COERULEA	10(T)	-(-)	45(1)	18(2)	16(1)	8(T)	4(1)	43(T)	-(-)	-(-)	12(T)
AQUILEGIA FORMOSA	5(T)	-(-)	-(-)	-(-)	9(5)	1(1)	4(1)	-(-)	-(-)	-(-)	3(4)
ARNICA CORDIFOLIA	10(5)	75(6)	-(-)	55(6)	3(9)	18(7)	18(9)	-(-)	6(35)	-(-)	3(1)
ARNICA LATIFOLIA	5(T)	-(-)	-(-)	-(-)	-(-)	-(-)	1(T)	-(-)	-(-)	-(-)	-(-)
ARTEMISIA LUDOVICIANA	-(-)	-(-)	18(3)	-(-)	1(14)	1(3)	4(2)	14(T)	-(-)	-(-)	3(13)
ASTER CHILENSIS	-(-)	-(-)	-(-)	-(-)	3(2)	5(1)	-(-)	-(-)	-(-)	-(-)	8(2)
ASTER ENGELMANNII	-(-)	50(T)	27(T)	9(T)	20(4)	8(2)	20(1)	-(-)	6(1)	-(-)	11(1)
ASTER FOLIACEUS	5(2)	-(-)	-(-)	-(-)	7(3)	13(2)	3(T)	-(-)	-(-)	-(-)	-(-)
ASTER PERELEGANS	-(-)	-(-)	-(-)	-(-)	5(1)	6(1)	6(T)	-(-)	-(-)	50(T)	2(2)
ASTRAGALUS MISER	20(3)	25(T)	-(-)	27(15)	2(3)	17(7)	9(1)	-(-)	17(13)	-(-)	14(10)
BALSAMORHIZA MACROPHYLLA	-(-)	-(-)	-(-)	-(-)	1(9)	1(T)	5(6)	-(-)	-(-)	-(-)	-(-)
BALSAMORHIZA SAGITTATA	-(-)	-(-)	-(-)	9(1)	2(2)	1(1)	6(4)	-(-)	-(-)	33(34)	3(2)
CALOCHORTUS NUTTALLII	15(T)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
CAMPANULA ROTUNDIFOLIA	-(-)	25(T)	-(-)	9(5)	-(-)	7(T)	1(T)	-(-)	-(-)	-(-)	-(-)
CASTILLEJA LINARIAEFOLIA	-(-)	50(8)	-(-)	9(T)	1(T)	8(T)	1(2)	-(-)	-(-)	-(-)	2(T)
CASTILLEJA MINIATA	15(T)	25(2)	-(-)	9(T)	12(1)	9(1)	9(2)	29(T)	28(T)	-(-)	8(2)
CIRSIUM ARVENSE	5(T)	-(-)	-(-)	18(T)	-(-)	2(T)	3(T)	14(T)	11(1)	-(-)	6(1)
CIRSIUM VULGARE	5(T)	-(-)	-(-)	-(-)	1(2)	-(-)	3(T)	-(-)	-(-)	-(-)	2(T)
CLAYTONIA LANCEOLATA	5(T)	-(-)	18(1)	-(-)	2(7)	-(-)	1(T)	-(-)	-(-)	-(-)	-(-)
CORALLORHIZA MACULATA	5(T)	-(-)	-(-)	-(-)	4(T)	3(T)	6(T)	-(-)	6(T)	50(T)	3(T)
CREPIS ACUMINATA	-(-)	-(-)	-(-)	-(-)	+(T)	1(T)	5(T)	-(-)	22(T)	17(T)	9(T)
DELPHINIUM NUTTALLIANUM	10(T)	-(-)	-(-)	-(-)	9(1)	7(T)	1(T)	-(-)	-(-)	-(-)	9(1)
DELPHINIUM OCCIDENTALE +	-(-)	-(-)	55(4)	9(4)	20(5)	3(T)	6(1)	14(T)	-(-)	-(-)	6(T)
DISPORUM TRACHYCARPUM	-(-)	-(-)	-(-)	-(-)	-(-)	1(T)	-(-)	-(-)	-(-)	-(-)	-(-)
EPILOBIUM ANGUSTIFOLIUM	-(-)	25(3)	-(-)	64(5)	7(3)	24(10)	8(6)	-(-)	6(T)	-(-)	3(T)
ERIGERON FLAGELLARIS	10(T)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	2(T)
ERIGERON PEREGRINUS	-(-)	-(-)	-(-)	-(-)	+(1)	-(-)	1(3)	-(-)	-(-)	-(-)	-(-)
ERIGERON SPECIOSUS	15(2)	25(T)	-(-)	-(-)	23(2)	22(1)	16(5)	-(-)	6(T)	-(-)	14(1)
FRAGARIA VESCA +	25(T)	25(T)	9(T)	82(14)	15(3)	33(3)	25(2)	14(T)	11(T)	-(-)	15(1)
FRASERA SPECIOSA	15(3)	-(-)	9(T)	36(2)	8(1)	33(2)	18(1)	14(T)	17(2)	-(-)	18(T)
FRITILLARIA ATROPURPUREA	5(T)	-(-)	-(-)	-(-)	+(T)	2(T)	3(T)	-(-)	6(T)	-(-)	2(T)
GALIUM BOREALE	20(2)	25(T)	-(-)	45(30)	10(1)	32(3)	20(1)	-(-)	6(1)	-(-)	14(1)
GERANIUM RICHARDSONII	5(T)	-(-)	-(-)	-(-)	5(11)	5(3)	3(1)	-(-)	6(3)	-(-)	2(T)
GERANIUM VISCOSISSIMUM +	30(2)	75(4)	9(10)	100(15)	41(6)	80(11)	71(10)	-(-)	28(T)	100(2)	41(1)
HABENARIA UNALASCENSIS	-(-)	-(-)	-(-)	-(-)	1(T)	9(T)	8(T)	-(-)	-(-)	-(-)	6(T)
HACKELIA FLORIBUNDA	-(-)	25(3)	45(2)	-(-)	55(5)	9(1)	25(3)	-(-)	-(-)	83(3)	21(1)
HACKELIA PATENS	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	3(1)	-(-)	-(-)	-(-)	2(3)
HEDYSARUM BOREALE	-(-)	-(-)	-(-)	9(20)	-(-)	3(3)	4(1)	-(-)	-(-)	-(-)	-(-)
HELENIUM HOOPESII	10(T)	-(-)	9(T)	-(-)	1(3)	6(2)	3(1)	29(T)	6(2)	-(-)	-(-)
HELIANTHELLA UNIFLORA	-(-)	-(-)	-(-)	9(T)	3(2)	10(2)	6(4)	-(-)	-(-)	33(1)	3(2)
HERACLEUM LANATUM	-(-)	-(-)	9(3)	-(-)	8(4)	1(T)	-(-)	-(-)	-(-)	-(-)	-(-)
HIERACIUM ALBIFLORUM	-(-)	25(T)	-(-)	9(2)	1(T)	1(T)	-(-)	-(-)	-(-)	-(-)	3(T)
HIERACIUM CYNOGLOSSOIDES	-(-)	-(-)	-(-)	-(-)	1(T)	19(T)	4(T)	-(-)	-(-)	-(-)	-(-)
HYDROPHYLLUM CAPITATUM	-(-)	-(-)	18(1)	-(-)	18(1)	1(T)	19(2)	-(-)	6(T)	17(T)	11(1)
LATHYRUS LANSZWERTII	5(23)	50(5)	-(-)	-(-)	31(15)	2(35)	9(29)	43(18)	-(-)	-(-)	15(14)
LATHYRUS LEUCANTHUS	10(26)	-(-)	9(15)	-(-)	7(13)	14(35)	5(25)	57(16)	6(T)	-(-)	12(11)
LATHYRUS PAUCIFLORUS	-(-)	-(-)	18(2)	-(-)	6(3)	-(-)	3(2)	-(-)	-(-)	-(-)	5(2)
LIGUSTICUM FILICINUM	-(-)	-(-)	18(T)	-(-)	3(1)	1(T)	1(T)	-(-)	-(-)	-(-)	-(-)
LUPINUS ARGENTEUS	25(5)	50(1)	-(-)	82(8)	15(7)	70(6)	24(7)	14(T)	67(8)	-(-)	12(7)
LUPINUS CAUDATUS	-(-)	-(-)	-(-)	-(-)	2(2)	-(-)	6(1)	-(-)	-(-)	17(T)	14(1)
LUPINUS LAXIFLORUS	-(-)	-(-)	-(-)	-(-)	5(3)	-(-)	8(3)	-(-)	-(-)	17(5)	8(2)
LUPINUS SERICEUS	-(-)	-(-)	-(-)	-(-)	+(2)	-(-)	-(-)	-(-)	28(7)	-(-)	11(5)
MERTENSIA ARIZONICA +	-(-)	25(5)	55(16)	-(-)	29(8)	9(2)	5(2)	14(T)	-(-)	-(-)	8(2)
MERTENSIA LONGIFLORA	-(-)	-(-)	-(-)	-(-)	+(T)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
OSMORHIZA CHILENSIS +	35(2)	50(1)	55(1)	64(2)	49(4)	52(6)	53(9)	14(T)	6(2)	67(3)	24(1)
OSMORHIZA OCCIDENTALIS	5(3)	25(T)	73(8)	-(-)	36(8)	8(1)	11(2)	-(-)	-(-)	17(2)	17(1)
PAEONIA BROWNII	-(-)	-(-)	-(-)	-(-)	2(1)	1(T)	4(1)	-(-)	-(-)	17(T)	3(1)
PENSTEMON PROCERUS	-(-)	-(-)	-(-)	-(-)	-(-)	1(4)	1(T)	-(-)	-(-)	-(-)	-(-)
PENSTEMON WATSONI	-(-)	-(-)	-(-)	-(-)	4(2)	-(-)	8(1)	14(2)	6(T)	-(-)	23(2)

(con.)

APPENDIX F (Con.)

	POTR/ POPR	POTR/ RUPA	POTR/ SARA	POTR/ SHCA	POTR/ SYOR/ TALL FORB	POTR/ SYOR/ CARU	POTR/ SYOR/ THFE	POTR/ SYOR/ FETH	POTR/ SYOR/ CARO	POTR/ SYOR/ WYAM	POTR/ SYOR/ BRCA
Number of Stands:	20	4	11	11	205	88	79	7	18	6	66
PERIDERIDIA GAIRDNERI	-(-)	-(-)	-(-)	-(-)	6(1)	31(1)	8(1)	-(-)	-(-)	-(-)	2(T)
PHACELIA HETEROPHYLLA	5(T)	-(-)	-(-)	-(-)	20(1)	1(T)	6(T)	14(T)	-(-)	-(-)	6(T)
POLEMONIUM FOLIOSISSIMUM +	-(-)	-(-)	82(3)	-(-)	23(1)	1(T)	3(T)	-(-)	-(-)	17(T)	9(1)
POTENTILLA GLANDULOSA	10(T)	25(3)	-(-)	55(7)	16(1)	42(2)	23(1)	-(-)	22(1)	50(T)	11(T)
POTENTILLA GRACILIS	25(T)	-(-)	-(-)	36(1)	10(1)	15(2)	14(1)	29(T)	17(1)	-(-)	8(T)
PTERIDIUM AQUILINUM	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	2(10)
RANUNCULUS INAMOENUS	20(T)	-(-)	18(T)	-(-)	-(-)	1(T)	-(-)	-(-)	-(-)	-(-)	2(T)
RUDBECKIA OCCIDENTALIS	10(1)	-(-)	45(12)	-(-)	56(13)	5(T)	13(1)	-(-)	-(-)	-(-)	15(2)
SCROPHULARIA LANCEOLATA	-(-)	-(-)	9(T)	-(-)	13(1)	-(-)	4(T)	-(-)	-(-)	-(-)	5(T)
SENECIO CRASSULUS	5(2)	-(-)	-(-)	-(-)	1(7)	1(T)	-(-)	14(1)	-(-)	-(-)	-(-)
SENECIO CYMBALARIOIDES	5(T)	25(T)	-(-)	-(-)	13(T)	5(T)	8(3)	-(-)	-(-)	-(-)	6(1)
SENECIO INTEGERRIMUS	10(T)	-(-)	-(-)	-(-)	3(T)	1(T)	5(1)	-(-)	-(-)	17(T)	3(T)
SENECIO SERRA +	5(T)	-(-)	45(4)	27(T)	58(5)	14(2)	11(1)	-(-)	-(-)	83(3)	12(1)
SENECIO STREPTANTHIFOLIUS	-(-)	25(T)	-(-)	18(T)	1(T)	-(-)	1(1)	-(-)	-(-)	-(-)	-(-)
SIDALCEA OREGANA	10(T)	-(-)	-(-)	-(-)	4(T)	1(T)	3(T)	-(-)	-(-)	17(T)	5(T)
SILENE MENZIESII	-(-)	-(-)	-(-)	18(T)	4(1)	11(1)	9(1)	-(-)	-(-)	-(-)	-(-)
SMILACINA RACEMOSA	-(-)	-(-)	-(-)	-(-)	9(1)	7(1)	9(1)	-(-)	-(-)	17(5)	-(-)
SMILACINA STELLATA	15(1)	-(-)	18(T)	9(T)	15(3)	35(2)	28(3)	43(1)	17(1)	-(-)	14(1)
STELLARIA JAMESIANA	10(1)	50(T)	45(6)	9(T)	46(2)	8(1)	27(2)	29(3)	33(T)	67(1)	39(3)
TARAXACUM OFFICINALE	95(7)	-(-)	27(2)	45(1)	32(1)	61(3)	54(3)	100(3)	83(4)	67(1)	52(2)
THALICTRUM FENDLERI +	40(1)	25(4)	73(13)	82(11)	58(11)	57(10)	59(16)	71(3)	17(2)	33(13)	33(2)
THERMOPSIS MONTANA	15(1)	-(-)	-(-)	-(-)	1(2)	5(6)	1(10)	-(-)	-(-)	-(-)	2(1)
TRAGOPOGON DUBIUS	5(T)	-(-)	-(-)	-(-)	3(T)	3(T)	5(1)	-(-)	-(-)	-(-)	11(T)
TRIFOLIUM LONGIPES	25(5)	-(-)	-(-)	-(-)	+(10)	1(1)	-(-)	-(-)	6(T)	-(-)	-(-)
URTICA DIOICA	5(T)	-(-)	18(T)	-(-)	+(T)	1(T)	3(T)	-(-)	-(-)	-(-)	-(-)
VALERIANA OCCIDENTALIS	15(1)	25(T)	55(8)	55(4)	55(6)	13(2)	16(3)	-(-)	-(-)	33(1)	8(2)
VERATRUM CALIFORNICUM	-(-)	-(-)	-(-)	-(-)	1(2)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
VERBASCUM THAPSUS	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	3(T)	-(-)	-(-)	-(-)	2(T)
VICIA AMERICANA	30(2)	25(5)	36(2)	-(-)	23(7)	10(9)	8(5)	86(6)	6(10)	-(-)	20(4)
VIGUIERA MULTIFLORA	-(-)	-(-)	-(-)	-(-)	9(5)	1(T)	-(-)	-(-)	17(T)	-(-)	5(T)
VIOLA ADUNCA	20(1)	-(-)	18(T)	27(T)	5(1)	14(2)	8(2)	-(-)	-(-)	-(-)	14(2)
VIOLA NUTTALLII	10(2)	-(-)	27(1)	-(-)	12(3)	2(T)	18(3)	-(-)	-(-)	50(4)	24(2)
VIOLA PURPUREA	-(-)	-(-)	-(-)	-(-)	3(T)	-(-)	4(1)	-(-)	6(T)	17(2)	3(T)
WYETHIA AMPLEXICAULIS	-(-)	-(-)	-(-)	9(T)	2(1)	2(T)	-(-)	-(-)	-(-)	100(29)	3(T)
ANNUALS											
ANDROSACE SEPTENTRIONALIS	-(-)	-(-)	9(T)	-(-)	1(1)	1(T)	3(T)	-(-)	6(T)	-(-)	5(T)
CHENOPODIUM FREMONTII	-(-)	25(T)	27(T)	-(-)	6(1)	1(T)	1(T)	14(T)	-(-)	-(-)	3(T)
COLLINSIA PARVIFLORA	10(T)	-(-)	-(-)	-(-)	9(8)	3(1)	8(6)	-(-)	-(-)	17(10)	8(2)
COLLOMIA LINEARIS	5(T)	25(T)	36(2)	-(-)	22(3)	5(2)	3(1)	-(-)	6(T)	-(-)	21(1)
DESCURAINIA RICHARDSONII	20(T)	-(-)	64(1)	-(-)	32(1)	3(T)	11(T)	57(T)	11(1)	33(T)	35(T)
GALIUM APARINE	-(-)	-(-)	-(-)	-(-)	+(T)	2(9)	1(3)	-(-)	-(-)	-(-)	-(-)
GALIUM BIFOLIUM	10(10)	-(-)	45(14)	9(10)	27(3)	5(3)	13(4)	-(-)	-(-)	83(5)	9(3)
MADIA GLOMERATA	-(-)	-(-)	-(-)	-(-)	+(T)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
NEMOPHILA BREVIFLORA	-(-)	-(-)	27(11)	-(-)	35(17)	3(12)	20(11)	-(-)	-(-)	83(7)	6(14)
POLYGONUM DOUGLASII	10(T)	-(-)	45(2)	-(-)	23(7)	3(8)	5(T)	-(-)	6(T)	17(2)	18(3)

(con.)

APPENDIX F (Con.)

	POTR/ SYOR/ POPR	POTR/ JUCO/ CAGE	POTR/ JUCO/ LUAR	POTR/ JUCO/ ASMI	POTR/ ARTR	POTR/ SASC	POTR/ AMAL- SYOR/ TALL FORB	POTR/ AMAL- SYOR/ THFE	POTR/ AMAL- SYOR/ CARU	POTR/ AMAL- SYOR/ BRCA	POTR/ AMAL/ PTAQ
Number of Stands:	36	23	14	14	27	13	96	40	68	21	10
TREES											
ABIES CONCOLOR	6(T)	-(-)	-(-)	-(-)	-(-)	-(-)	13(2)	3(T)	-(-)	14(1)	30(3)
ABIES LASIOCARPA	11(3)	13(T)	-(-)	21(4)	-(-)	-(-)	6(4)	20(1)	15(T)	19(1)	10(1)
PICEA ENGELMANNII	6(3)	17(2)	7(1)	14(1)	4(T)	(-)	-(-)	3(T)	1(1)	-(-)	-( )
PICEA PUNGENS	3(1)	4(T)	21(T)	14(3)	-(-)	-(-)	-(-)	-(-)	( )	(-)	-(-)
PINUS CONTORTA	-(-)	26(2)	21(T)	36(3)	26(1)	-(-)	1(4)	8(3)	9(3)	10(2)	-(-)
PINUS FLEXILIS	-(-)	4(T)	14(1)	7(2)	11(T)	-(-)	1(T)	-(-)	-(-)	-(-)	-(-)
PINUS PONDEROSA	17(3)	4(1)	7(T)	14(4)	4(6)	-(-)	-(-)	-(-)	1(T)	-(-)	-(-)
POPULUS TREMULOIDES	100(69)	100(76)	100(72)	100(74)	100(60)	100(61)	100(71)	100(73)	100(75)	100(68)	100(68)
POPULUS TREMULOIDES (reprod.)	78(3)	65(3)	79(6)	79(5)	85(3)	77(4)	78(5)	68(7)	87(5)	67(8)	90(3)
PSEUDOTSUGA MENZIESII	11(1)	26(1)	21(1)	43(2)	4(1)	-(-)	7(2)	30(1)	32(2)	14(1)	-(-)
SHRUBS											
ACER GLABRUM	-(-)	-(-)	-(-)	7(2)	-(-)	8(T)	2(T)	3(T)	3(3)	-(-)	10(T)
ACER GRANDIDENTATUM	11(1)	-(-)	-(-)	-(-)	4(T)	15(6)	24(17)	18(3)	15(6)	48(23)	90(17)
AMELANCHIER ALNIFOLIA	25(2)	17(2)	36(2)	29(2)	15(1)	62(9)	80(13)	83(13)	93(23)	95(9)	60(6)
ARCTOSTAPHYLOS UVA-URSI	-(-)	22(5)	29(9)	36(4)	4(25)	-(-)	-(-)	-( )	3(2)	-(-)	-(-)
ARTEMISIA TRIDENTATA	19(1)	22(1)	43(1)	43(3)	100(21)	-(-)	3(4)	8(T)	1(1)	10(13)	-(-)
BERBERIS REPENS	39(1)	52(6)	79(15)	64(11)	33(3)	23(5)	41(6)	63(6)	75(6)	76(9)	40(22)
CEANOTHUS VELUTINUS	3(T)	-(-)	-(-)	-(-)	-(-)	( )	2(3)	10(2)	15(7)	5(20)	-(-)
CERCOCARPUS LEDIFOLIUS	6(1)	-(-)	-(-)	(-)	-(-)	(-)	1(5)	3(3)	-(-)	-(-)	-(-)
CHRYSOTHAMNUS VISCIDIFLORUS	3(T)	-(-)	-(-)	-(-)	15(T)	-(-)	-(-)	3(T)	-(-)	-(-)	-(-)
JUNIPERUS COMMUNIS	8(1)	100(24)	100(20)	100(28)	33(09)	-(-)	-(-)	3(2)	4(2)	5(2)	-(-)
LONICERA INVOLUCRATA	-(-)	-(-)	-(-)	(-)	-(-)	-(-)	1(2)	3(T)	3(T)	-(-)	-(-)
PACHISTIMA MYRSINITES	3(T)	9(T)	7(30)	14(2)	4(T)	15(26)	17(20)	38(6)	53(21)	29(4)	10(1)
PHYSOCARPUS MALVACEUS	-(-)	-(-)	-(-)	-(-)	-(-)	8(5)	5(18)	5(20)	6(10)	14(8)	20(11)
PRUNUS VIRGINIANA	19(1)	-( )	(-)	-(-)	11(T)	38(8)	81(22)	78(19)	79(17)	67(16)	90(10)
QUERCUS GAMBELII	22(5)	-(-)	-(-)	-(-)	4(T)	-(-)	5(3)	10(3)	-(-)	19(3)	10(10)
RIBES CEREUM	-(-)	( )	-(-)	-(-)	7(T)	23(2)	10(4)	8(1)	-(-)	-(-)	-(-)
RIBES INERME	(-)	-(-)	-(-)	-(-)	-(-)	8(2)	4(5)	-(-)	-(-)	-(-)	-(-)
RIBES LACUSTRE	6(3)	-( )	-(-)	-(-)	-(-)	-(-)	1(T)	-(-)	-(-)	-(-)	-(-)
RIBES VISCOSISSIMUM	-(-)	-(-)	-(-)	7(T)	-(-)	-(-)	-(-)	-(-)	1(T)	-(-)	-(-)
ROSA WOODSII +	39(10)	39(1)	50(1)	57(2)	22(2)	62(6)	57(5)	80(6)	88(6)	76(2)	60(2)
RUBUS PARVIFLORUS	(-)	(-)	-(-)	-(-)	-(-)	31(8)	1(T)	5(16)	-(-)	-(-)	10(T)
SALIX SCOULERIANA	3(3)	-( )	-(-)	-(-)	-(-)	100(24)	4(3)	5(1)	12(3)	-(-)	-(-)
SAMBUCUS RACEMOSA +	3(T)	-(-)	-(-)	-(-)	4(T)	-(-)	14(1)	5(2)	-(-)	5(T)	20(2)
SHEPHERDIA CANADENSIS	-(-)	4(T)	7(T)	( )	-(-)	15(3)	2(1)	13(3)	6(7)	5(15)	-(-)
SORBUS SCOPULINA	-(-)	-(-)	-(-)	-( )	-(-)	15(18)	5(8)	3(T)	10(.1)	-(-)	-(-)
SPIRAEA BETULIFOLIA	-(-)	-(-)	-(-)	-(-)	-(-)	8(T)	2(38)	8(25)	22(31)	5(T)	-(-)
SYMPHORICARPOS ALBUS	-(-)	4(20)	-(-)	-(-)	-( )	-(-)	4(8)	15(32)	54(18)	-(-)	-(-)
SYMPHORICARPOS OREOPHILUS	100(32)	78(8)	79(13)	71(5)	81(8)	77(9)	97(27)	80(20)	40(17)	100(26)	60(7)
GRAMINOIDS											
AGROPYRON SPICATUM	-(-)	9(4)	-(-)	-(-)	7(T)	-(-)	-(-)	-(-)	1(T)	-(-)	-(-)
AGROPYRON TRACHYCAULUM +	50(1)	61(2)	57(4)	64(3)	67(6)	23(2)	39(2)	38(2)	26(1)	57(6)	50(T)
BROMUS ANOMALUS	3(T)	4(T)	21(28)	7(T)	19(5)	-(-)	2(20)	-(-)	3(T)	-(-)	-(-)
BROMUS CARINATUS +	33(1)	30(2)	7(2)	-(-)	22(4)	54(7)	53(6)	45(6)	25(1)	52(8)	60(7)
BROMUS CILIATUS	8(1)	35(3)	7(T)	29(2)	11(9)	-(-)	5(3)	5(4)	10(T)	-(-)	-(-)
CALAMAGROSTIS RUBESCENS	-(-)	4(38)	-(-)	-(-)	-(-)	8(10)	16(18)	28(7)	93(41)	10(3)	-(-)
CAREX GEYERI	3(5)	96(31)	29(4)	21(3)	11(25)	-(-)	15(2)	18(2)	24(34)	10(4)	-(-)
CAREX HOODII	19(1)	-(-)	-(-)	7(T)	11(T)	15(3)	30(2)	15(2)	13(2)	14(2)	-(-)
CAREX ROSSII	8(1)	9(3)	7(T)	14(1)	26(14)	-(-)	2(T)	3(1)	-(-)	-(-)	-(-)
DACTYLIS GLOMERATA	19(5)	4(T)	-(-)	-(-)	4(T)	-(-)	4(5)	3(T)	-(-)	10(10)	10(T)
ELYMUS CINEREUS	8(4)	-(-)	-(-)	-(-)	7(1)	-(-)	10(1)	5(2)	1(3)	10(2)	-(-)
ELYMUS GLAUCUS	17(1)	9(2)	7(T)	14(19)	4(5)	62(10)	75(12)	63(11)	84(6)	71(13)	80(17)
FESTUCA IDAHOENSIS +	6(3)	4(T)	21(6)	7(5)	15(5)	-(-)	2(T)	3(1)	3(T)	5(2)	-(-)
FESTUCA THURBERI	8(T)	-( )	-(-)	-(-)	(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
HORDEUM JUBATUM	(-)	-( )	7(T)	-(-)	4(1)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
KOELERIA CRISTATA	( )	4(1)	-( )	-(-)	15(T)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
LEUCOPOA KINGII	(-)	-(-)	-(-)	43(6)	26(3)	-(-)	1(3)	-(-)	-(-)	-(-)	-(-)
MELICA SPECTABILIS	6(T)	-(-)	-(-)	-(-)	19(4)	15(1)	18(1)	5(2)	10(T)	10(20)	-(-)
PHLEUM ALPINUM	3(T)	4(3)	-(-)	7(T)	-(-)	-(-)	2(19)	3(T)	9(22)	-(-)	-(-)
PHLEUM PRATENSE	3(T)	4(T)	-(-)	7(3)	-(-)	-(-)	3(T)	8(1)	9(2)	10(1)	10(T)
POA AMPLA	-(-)	17(T)	14(1)	-(-)	7(5)	-(-)	1(T)	-(-)	-(-)	-(-)	-(-)
POA FENDLERIANA	6(T)	-(-)	21(38)	14(T)	15(8)	-(-)	-(-)	-(-)	-(-)	5(10)	-(-)
POA NERVOSA	3(5)	4(3)	7(2)	14(1)	26(5)	-(-)	13(2)	13(2)	1(T)	10(5)	10(T)
POA PALUSTRIS	-(-)	13(1)	-(-)	-(-)	-(-)	-(-)	2(T)	-(-)	6(1)	-(-)	-(-)
POA PRATENSIS	100(35)	39(14)	21(11)	21(2)	22(3)	31(5)	38(16)	40(19)	25(3)	52(27)	30(1)
SITANION HYSTRIX	11(T)	-(-)	21(2)	14(1)	15(2)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
STIPA COMATA	3(T)	-(-)	14(6)	21(3)	22(8)	-(-)	-(-)	-(-)	-(-)	-(-)	-( )
STIPA OCCIDENTALIS +	22(4)	83(6)	50(7)	43(4)	44(8)	-(-)	7(1)	18(4)	3(2)	14(14)	10(T)
TRISETUM SPICATUM	-(-)	13(T)	-(-)	14(3)	4(5)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)

(con.)

APPENDIX F (Con.)

	POTR/ SYOR/ POPR	POTR/ JUCO/ CAGE	POTR/ JUCO/ LUAR	POTR/ JUCO/ ASMI	POTR/ ARTR	POTR/ SASC	POTR/ AMAL-SYOR/ TALL FORB	POTR/ AMAL SYOR/ THFE	POTR/ AMAL SYOR/ CARU	POTR/ AMAL-SYOR/ BRCA	POTR/ AMAL/ PTAQ
Number of Stands:	36	23	14	14	27	13	96	40	68	21	10
FORBS											
ACHILLEA MILLEFOLIUM	78(2)	74(2)	36(1)	93(2)	33(2)	31(2)	52(2)	45(1)	62(2)	43(1)	10(T)
ACONITUM COLUMBIANUM	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	1(T)	-(-)	-(-)	-(-)	-(-)
ACTAEA RUBRA	-(-)	-(-)	-(-)	-(-)	-(-)	23(1)	2(T)	-(-)	3(T)	-(-)	10(1)
AGASTACHE URTICIFOLIA	25(2)	-(-)	-(-)	-(-)	7(10)	54(3)	73(7)	35(1)	10(1)	43(1)	40(6)
AGOSERIS AURANTIACA	3(2)	-(-)	-(-)	-(-)	-(-)	-(-)	1(T)	3(T)	3(T)	-(-)	-(-)
AGOSERIS GLAUCA	8(T)	17(T)	7(T)	29(T)	15(T)	-(-)	5(T)	-(-)	10(T)	5(T)	-(-)
ALLIUM BREVISTYLUM	3(T)	-(-)	7(T)	7(T)	-(-)	-(-)	5(T)	-(-)	-(-)	-(-)	-(-)
ANGELICA PINNATA	-(-)	-(-)	-(-)	7(3)	-(-)	8(T)	2(T)	3(T)	-(-)	-(-)	-(-)
ANTENNARIA MICROPHYLLA	17(T)	61(1)	43(5)	36(3)	41(5)	-(-)	-(-)	-(-)	-(-)	5(T)	-(-)
APOCYNUM ANDROSAEMIFOLIUM	-(-)	-(-)	-(-)	7(T)	4(T)	-(-)	5(3)	10(1)	10(T)	5(T)	10(T)
AQUILEGIA COERULEA	3(T)	13(1)	14(T)	29(1)	-(-)	-(-)	5(T)	3(2)	-(-)	5(T)	20(T)
AQUILEGIA FORMOSA	3(1)	-(-)	-(-)	-(-)	-(-)	23(5)	7(7)	-(-)	-(-)	-(-)	-(-)
ARNICA CORDIFOLIA	-(-)	-(-)	7(1)	7(10)	4(T)	38(10)	7(6)	13(10)	24(8)	10(5)	-(-)
ARNICA LATIFOLIA	-(-)	-(-)	7(T)	14(T)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
ARTEMISIA LUDOVICIANA	3(T)	-(-)	-(-)	-(-)	-(-)	8(2)	2(T)	5(2)	1(T)	-(-)	-(-)
ASTER CHILENSIS	8(5)	4(T)	-(-)	-(-)	4(2)	-(-)	4(T)	8(1)	6(1)	-(-)	-(-)
ASTER ENGELMANNII	6(T)	-(-)	-(-)	-(-)	-(-)	15(6)	46(6)	25(1)	18(2)	38(1)	60(2)
ASTER FOLIACEUS	3(5)	-(-)	-(-)	-(-)	-(-)	-(-)	4(1)	10(4)	24(2)	-(-)	-(-)
ASTER PERELEGANS	-(-)	-(-)	-(-)	7(T)	7(8)	8(T)	6(1)	5(1)	-(-)	5(T)	-(-)
ASTRAGALUS MISER	3(T)	70(11)	29(8)	100(7)	19(7)	-(-)	1(3)	-(-)	3(2)	5(5)	-(-)
BALSAMORHIZA MACROPHYLLA	3(10)	-(-)	-(-)	-(-)	-(-)	-(-)	5(4)	3(5)	1(T)	-(-)	-(-)
BALSAMORHIZA SAGITTATA	-(-)	-(-)	-(-)	-(-)	4(T)	15(T)	5(1)	10(3)	3(1)	-(-)	-(-)
CALOCHORTUS NUTTALLII	6(T)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	1(T)	-(-)	-(-)
CAMPANULA ROTUNDIFOLIA	6(T)	43(T)	7(T)	21(T)	4(T)	-(-)	-(-)	3(T)	7(T)	-(-)	-(-)
CASTILLEJA LINARIAEFOLIA	6(T)	-(-)	-(-)	7(T)	-(-)	-(-)	-(-)	8(T)	15(T)	5(T)	-(-)
CASTILLEJA MINIATA	8(1)	30(1)	14(T)	14(T)	11(1)	-(-)	11(1)	8(T)	9(1)	10(T)	-(-)
CIRSIUM ARVENSE	6(T)	4(T)	7(T)	-(-)	-(-)	-(-)	1(T)	3(T)	1(T)	-(-)	-(-)
CIRSIUM VULGARE	3(5)	-(-)	-(-)	-(-)	-(-)	-(-)	1(T)	-(-)	-(-)	5(T)	-(-)
CORALLORHIZA MACULATA	6(T)	4(T)	-(-)	7(T)	-(-)	31(T)	4(1)	10(T)	1(T)	-(-)	10(T)
CREPIS ACUMINATA	-(-)	4(T)	-(-)	-(-)	15(T)	-(-)	2(T)	-(-)	-(-)	-(-)	-(-)
DELPHINIUM NUTTALLIANUM	28(1)	4(T)	-(-)	7(T)	7(T)	-(-)	1(T)	-(-)	-(-)	-(-)	-(-)
DELPHINIUM OCCIDENTALE +	3(T)	9(1)	-(-)	-(-)	-(-)	15(T)	20(4)	8(T)	6(1)	-(-)	20(T)
DISPORUM TRACHYCARPUM	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	2(T)	10(1)	13(1)	-(-)	20(T)
EPILOBIUM ANGUSTIFOLIUM	-(-)	4(T)	7(T)	-(-)	-(-)	46(7)	17(1)	10(2)	35(5)	-(-)	10(T)
ERIGERON FLAGELLARIS	6(T)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
ERIGERON PEREGRINUS	-(-)	13(5)	7(T)	29(T)	7(T)	-(-)	1(1)	-(-)	1(3)	-(-)	-(-)
ERIGERON SPECIOSUS	8(T)	30(1)	14(3)	21(1)	11(7)	-(-)	19(1)	23(3)	16(1)	10(1)	-(-)
FRAGARIA VESCA +	8(5)	4(T)	14(3)	21(2)	11(4)	-(-)	18(2)	23(2)	31(2)	14(2)	-(-)
FRASERA SPECIOSA	11(T)	26(T)	7(T)	-(-)	-(-)	15(3)	9(2)	15(T)	15(1)	19(2)	-(-)
FRITILLARIA ATROPURPUREA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	1(T)	-(-)	3(T)	-(-)	-(-)
GALIUM BOREALE	3(T)	35(1)	14(T)	57(2)	7(T)	15(T)	17(3)	15(T)	29(2)	43(1)	50(2)
GERANIUM RICHARDSONII	3(2)	4(5)	-(-)	7(3)	-(-)	-(-)	-(-)	5(2)	1(1)	-(-)	-(-)
GERANIUM VISCOSISSIMUM +	28(1)	83(11)	29(1)	57(1)	30(1)	23(4)	51(4)	80(9)	90(8)	57(2)	10(T)
HABENARIA UNALASCENSIS	-(-)	9(T)	-(-)	7(T)	-(-)	-(-)	7(T)	18(T)	22(T)	10(T)	-(-)
HACKELIA FLORIBUNDA	28(2)	4(T)	-(-)	7(T)	11(1)	38(5)	47(3)	28(1)	1(T)	19(T)	-(-)
HACKELIA PATENS	-(-)	-(-)	-(-)	-(-)	4(1)	-(-)	2(1)	-(-)	-(-)	-(-)	-(-)
HELENIUM HOOPESII	22(1)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	5(T)	-(-)
HELIANTHELLA UNIFLORA	3(T)	-(-)	-(-)	-(-)	11(4)	-(-)	4(1)	13(1)	10(1)	10(T)	-(-)
HERACLEUM LANATUM	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	6(9)	3(T)	1(T)	-(-)	30(6)
HIERACIUM ALBIFLORUM	-(-)	4(T)	-(-)	-(-)	-(-)	-(-)	-(-)	3(T)	9(1)	-(-)	-(-)
HIERACIUM CYNOGLOSSOIDES	6(T)	-(-)	-(-)	-(-)	-(-)	-(-)	6(T)	3(T)	28(T)	5(T)	-(-)
HYDROPHYLLUM CAPITATUM	6(T)	-(-)	-(-)	-(-)	-(-)	23(2)	10(1)	5(T)	1(T)	10(T)	10(T)
LATHYRUS LANSZWERTII	17(16)	9(8)	-(-)	-(-)	-(-)	15(23)	24(5)	3(15)	1(3)	43(20)	10(T)
LATHYRUS LEUCANTHUS	28(17)	-(-)	-(-)	-(-)	-(-)	8(25)	11(14)	5(15)	-(-)	14(34)	10(13)
LATHYRUS PAUCIFLORUS	3(T)	-(-)	-(-)	-(-)	-(-)	-(-)	11(8)	5(5)	-(-)	-(-)	30(3)
LIGUSTICUM FILICINUM	-(-)	-(-)	-(-)	14(T)	-(-)	-(-)	6(10)	8(2)	4(17)	-(-)	-(-)
LUPINUS ARGENTEUS	47(3)	57(7)	93(13)	29(1)	33(11)	8(5)	18(5)	43(6)	82(8)	48(6)	10(T)
LUPINUS CAUDATUS	3(T)	-(-)	7(30)	-(-)	4(2)	-(-)	4(1)	8(1)	-(-)	5(1)	-(-)
LUPINUS LAXIFLORUS	3(2)	-(-)	-(-)	-(-)	11(6)	8(3)	3(1)	-(-)	-(-)	-(-)	-(-)
LUPINUS SERICEUS	-(-)	-(-)	-(-)	-(-)	26(3)	-(-)	1(T)	-(-)	-(-)	-(-)	-(-)
MERTENSIA ARIZONICA +	8(1)	-(-)	-(-)	-(-)	-(-)	-(-)	23(3)	13(T)	-(-)	10(T)	10(5)
MERTENSIA LONGIFLORA	-(-)	-(-)	-(-)	-(-)	4(T)	-(-)	1(T)	-(-)	1(T)	-(-)	-(-)
OSMORHIZA CHILENSIS +	22(1)	39(2)	-(-)	21(1)	4(T)	92(10)	56(5)	55(9)	69(8)	43(3)	60(4)
OSMORHIZA OCCIDENTALIS	6(4)	-(-)	-(-)	-(-)	-(-)	31(14)	35(4)	15(2)	7(T)	10(3)	10(5)
PAEONIA BROWNII	-(-)	-(-)	-(-)	-(-)	-(-)	8(T)	2(T)	8(2)	3(T)	-(-)	-(-)
PENSTEMON PROCERUS	-(-)	-(-)	-(-)	-(-)	7(1)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
PENSTEMON WATSONI	-(-)	-(-)	-(-)	-(-)	22(3)	8(T)	3(1)	8(1)	-(-)	-(-)	-(-)

(con.)

	POTR/ SYOR/ POPR	POTR/ JUCO/ CAGE	POTR/ JUCO/ LUAR	POTR/ JUCO/ ASMI	POTR/ ARTR	POTR/ SASC	POTR/ AMAL- SYOR/ TALL FORB	POTR/ AMAL- SYOR/ THFE	POTR/ AMAL- SYOR/ CARU	POTR/ AMAL- SYOR/ BRCA	POTR/ AMAL/ PTAQ
Number of Stands:	36	23	14	14	27	13	96	40	68	21	10
PERIDERIDIA GAIRDNERI	-(-)	-(-)	7(T)	-(-)	4(T)	8(1)	11(1)	13(T)	51(1)	5(T)	-(-)
PHACELIA HETEROPHYLLA	14(1)	-(-)	-(-)	-(-)	4(T)	8(T)	23(T)	10(T)	1(T)	10(T)	20(T)
POLEMONIUM FOLIOSISSIMUM +	3(T)	-(-)	-(-)	-(-)	4(T)	-(-)	14(1)	5(T)	-(-)	14(T)	30(T)
POTENTILLA DIVERSIFOLIA	6(T)	-(-)	7(T)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
POTENTILLA GLANDULOSA	11(1)	4(T)	-(-)	-(-)	15(1)	8(2)	14(1)	18(1)	31(1)	10(T)	-(-)
POTENTILLA GRACILIS	3(T)	74(2)	29(T)	43(T)	7(T)	-(-)	5(1)	5(3)	12(2)	-(-)	-(-)
PTERIDIUM AQUILINUM	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	100(41)
RANUNCULUS INAMOENUS	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	5(T)	-(-)
RUDBECKIA OCCIDENTALIS	11(2)	4(T)	-(-)	-(-)	-(-)	8(25)	32(5)	15(2)	3(2)	19(2)	30(5)
SCROPHULARIA LANCEOLATA	-(-)	-(-)	-(-)	-(-)	-(-)	8(5)	10(1)	-(-)	1(T)	5(T)	40(T)
SENECIO CRASSULUS	-(-)	4(T)	-(-)	-(-)	-(-)	-(-)	3(T)	5(5)	4(7)	-(-)	-(-)
SENECIO CYMBALARIOIDES	14(1)	-(-)	7(5)	21(T)	11(7)	-(-)	18(1)	5(3)	12(T)	19(T)	-(-)
SENECIO INTEGERRIMUS	8(T)	9(T)	-(-)	-(-)	15(1)	-(-)	6(3)	8(1)	-(-)	-(-)	-(-)
SENECIO SERRA +	17(1)	-(-)	7(2)	-(-)	4(5)	46(4)	52(5)	30(1)	12(2)	29(1)	30(9)
SENECIO STREPTANTHIFOLIUS	-(-)	4(T)	-(-)	-(-)	7(1)	-(-)	1(T)	3(T)	-(-)	10(T)	-(-)
SIDALCEA OREGANA	8(T)	-(-)	-(-)	-(-)	4(T)	8(2)	1(T)	-(-)	-(-)	-(-)	-(-)
SILENE MENZIESII	-(-)	-(-)	7(T)	-(-)	7(T)	8(2)	9(2)	5(T)	19(1)	14(1)	20(T)
SMILACINA RACEMOSA	-(-)	-(-)	-(-)	-(-)	-(-)	54(6)	15(4)	18(1)	31(1)	10(T)	30(T)
SMILACINA STELLATA	8(T)	22(T)	7(10)	21(T)	11(T)	31(1)	19(3)	45(3)	43(2)	29(7)	50(17)
STELLARIA JAMESIANA	28(T)	61(1)	-(-)	7(2)	33(2)	38(2)	35(4)	8(1)	4(1)	24(2)	30(1)
TARAXACUM OFFICINALE	86(4)	83(11)	50(4)	79(4)	59(1)	54(2)	34(1)	38(2)	57(2)	43(1)	30(T)
THALICTRUM FENDLERI +	17(1)	26(11)	43(2)	64(2)	22(4)	69(21)	73(11)	73(14)	81(10)	57(2)	50(2)
THERMOPSIS MONTANA	8(5)	4(10)	-(-)	-(-)	4(25)	-(-)	1(2)	3(5)	-(-)	5(5)	10(T)
TRAGOPOGON DUBIUS	14(1)	4(T)	7(T)	-(-)	-(-)	8(T)	1(T)	10(T)	9(T)	10(T)	-(-)
TRIFOLIUM GYMNOCARPON	-(-)	-(-)	-(-)	7(7)	-(-)	-(-)	1(T)	-(-)	-(-)	-(-)	-(-)
TRIFOLIUM LONGIPES	-(-)	4(T)	7(T)	14(2)	7(5)	-(-)	-(-)	-(-)	1(3)	-(-)	10(T)
URTICA DIOICA	-(-)	-(-)	-(-)	-(-)	-(-)	8(1)	1(1)	-(-)	1(T)	-(-)	10(10)
VALERIANA OCCIDENTALIS	8(T)	-(-)	-(-)	-(-)	-(-)	38(4)	40(4)	13(1)	7(3)	14(1)	40(3)
VERATRUM CALIFORNICUM	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	1(T)	-(-)	-(-)	-(-)	-(-)
VERBASCUM THAPSUS	3(T)	-(-)	-(-)	-(-)	-(-)	-(-)	3(T)	5(T)	1(T)	5(T)	-(-)
VICIA AMERICANA	42(9)	-(-)	-(-)	-(-)	4(T)	8(T)	24(5)	15(5)	1(T)	19(21)	40(2)
VIGUIERA MULTIFLORA	3(3)	-(-)	-(-)	7(5)	4(T)	-(-)	4(T)	5(1)	4(1)	5(T)	-(-)
VIOLA ADUNCA	17(T)	9(T)	-(-)	-(-)	4(T)	31(2)	10(1)	8(1)	15(T)	19(2)	10(2)
VIOLA NUTTALLII	6(1)	13(2)	-(-)	-(-)	-(-)	23(2)	15(3)	10(3)	9(1)	-(-)	10(T)
VIOLA PURPUREA	-(-)	-(-)	-(-)	-(-)	4(T)	-(-)	4(1)	3(T)	-(-)	-(-)	-(-)
WYETHIA AMPLEXICAULIS	3(T)	-(-)	-(-)	-(-)	-(-)	8(1)	5(3)	3(T)	6(T)	5(T)	-(-)
ANNUALS											
ANDROSACE SEPTENTRIONALIS	-(-)	9(T)	-(-)	-(-)	-(-)	-(-)	2(T)	3(T)	-(-)	-(-)	-(-)
CHENOPODIUM FREMONTII	3(2)	-(-)	7(T)	-(-)	4(T)	-(-)	4(T)	5(T)	3(T)	-(-)	-(-)
COLLINSIA PARVIFLORA	3(10)	-(-)	-(-)	7(T)	4(T)	15(2)	7(4)	3(3)	13(4)	-(-)	-(-)
COLLOMIA LINEARIS	6(T)	-(-)	-(-)	-(-)	7(1)	8(T)	4(T)	8(7)	6(3)	-(-)	-(-)
DESCURAINIA RICHARDSONII	28(1)	-(-)	-(-)	-(-)	11(T)	23(T)	27(1)	10(T)	-(-)	14(T)	40(1)
GALIUM APARINE	-(-)	-(-)	-(-)	-(-)	-(-)	15(3)	5(4)	3(3)	-(-)	10(T)	10(7)
GALIUM BIFOLIUM	6(T)	-(-)	-(-)	-(-)	-(-)	46(3)	21(4)	10(T)	4(8)	-(-)	20(2)
MADIA GLOMERATA	3(T)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
NEMOPHILA BREVIFLORA	14(6)	-(-)	-(-)	-(-)	4(5)	31(14)	25(13)	8(15)	4(20)	10(3)	40(13)
POLYGONUM DOUGLASII	8(1)	13(T)	14(T)	7(T)	7(1)	-(-)	21(2)	8(4)	10(8)	5(1)	20(3)

(con.)

APPENDIX F (Con.)

	POTR/ AMAL/ TALL FORB	POTR/ AMAL/ THFE	POTR- ABLA/ SHCA	POTR- ABLA/ AMAL	POTR ABLA/ SYOR/ TALL FORB	POTR- ABLA/ SYOR/ THFE	POTR- ABLA/ SYOR/ BRCA	POTR- ABLA/ JUCO	POTR ABLA/ TALL FORB	POTR- ABLA/ THFE	POTR- ABLA/ CAGE
Number of Stands:	39	20	11	11	20	15	10	19	51	[illegible]	1[illegible]
TREES											
ABIES CONCOLOR	3(T)	-(-)	-(-)	9(10)	5(5)	-(-)	-(-)	-(-)	4(6)	3([illegible])	-(-)
ABIES LASIOCARPA	-(-)	5(5)	100(17)	91(17)	100(22)	100(23)	100(19)	95(28)	100(21)	[illegible]	92(38)
PICEA ENGELMANNII	-(-)	-(-)	18(18)	18(11)	15(10)	20(17)	10(6)	32(18)	24(9)	37(3)	46(4)
PICEA PUNGENS	-(-)	-(-)	-(-)	-(-)	-(-)	7(5)	10(10)	16(10)	-(-)	[illegible]	-(-)
PINUS CONTORTA	-(-)	10(5)	27(14)	9(8)	-(-)	20(13)	10(T)	16(9)	10(4)	20(7)	15(6)
PINUS FLEXILIS	-(-)	-(-)	36(2)	-(-)	-(-)	13(T)	-(-)	42(4)	4(T)	17(1)	-(-)
PINUS PONDEROSA	-(-)	5(5)	-(-)	-(-)	-(-)	-(-)	-(-)	5(4)	-(-)	3(T)	-(-)
POPULUS TREMULOIDES	100(70)	100(75)	100(68)	100(69)	100(58)	100(65)	100(64)	100(58)	100(66)	100(64)	100(71)
POPULUS TREMULOIDES (reprod.)	90(5)	95(6)	9(T)	55(5)	75(4)	67(3)	40(3)	74(2)	57(6)	69(3)	62(4)
PSEUDOTSUGA MENZIESII	5(T)	20(1)	18(4)	27(9)	25(3)	47(9)	40(1)	21(6)	6(5)	20(4)	46(9)
SHRUBS											
ACER GLABRUM	-(-)	10(2)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	8(T)
ACER GRANDIDENTATUM	18(27)	25(19)	-(-)	36(6)	-(-)	-(-)	-(-)	-(-)	-(-)	3(T)	-(-)
AMELANCHIER ALNIFOLIA	74(13)	85(18)	36(6)	100(7)	20(6)	47(1)	20(1)	-(-)	6(2)	20(1)	38(T)
ARCTOSTAPHYLOS PATULA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	5(40)	-(-)	-(-)	-(-)
ARCTOSTAPHYLOS UVA-URSI	-(-)	5(5)	-(-)	-(-)	-(-)	-(-)	-(-)	5(T)	-(-)	3(T)	-(-)
ARTEMISIA TRIDENTATA	-(-)	5(T)	-(-)	9(1)	15(4)	-(-)	-(-)	-(-)	2(T)	-(-)	-(-)
BERBERIS REPENS	36(2)	75(11)	73(6)	82(4)	25(2)	60(5)	50(1)	47(2)	14(1)	31(3)	54(8)
CEANOTHUS VELUTINUS	3(25)	-(-)	-(-)	9(T)	5(T)	13(4)	-(-)	-(-)	-(-)	6(1)	-(-)
CERCOCARPUS LEDIFOLIUS	-(-)	-(-)	-(-)	-(-)	-(-)	7(5)	-(-)	-(-)	-(-)	-(-)	-(-)
CHRYSOTHAMNUS VISCIDIFLORUS	-(-)	-(-)	-(-)	9(1)	-(-)	-(-)	-(-)	21(1)	-(-)	-(-)	-(-)
JUNIPERUS COMMUNIS	-(-)	-(-)	18(2)	-(-)	5(1)	13(2)	20(2)	100(10)	2(T)	11(1)	31(2)
LONICERA INVOLUCRATA	-(-)	5(3)	27(2)	-(-)	5(3)	7(T)	-(-)	-(-)	2(T)	-(-)	8(T)
PACHISTIMA MYRSINITES	3(T)	25(1)	82(16)	55(7)	25(8)	40(5)	10(3)	-(-)	6(T)	40(1)	31(1)
PHYSOCARPUS MALVACEUS	3(T)	10(9)	-(-)	18(47)	15(27)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
PRUNUS VIRGINIANA	79(35)	75(22)	9(1)	55(23)	10(1)	7(7)	-(-)	5(T)	-(-)	11(T)	8(T)
QUERCUS GAMBELII	3(T)	-(-)	-(-)	9(20)	-(-)	-(-)	10(3)	-(-)	-(-)	-(-)	-(-)
RIBES CEREUM	28(3)	5(15)	-(-)	-(-)	-(-)	13(1)	-(-)	-(-)	4(3)	3(T)	-(-)
RIBES INERME	10(1)	-(-)	-(-)	-(-)	5(T)	-(-)	-(-)	-(-)	2(2)	3(T)	-(-)
RIBES LACUSTRE	-(-)	5(75)	9(1)	9(3)	-(-)	7(T)	-(-)	-(-)	2(5)	-(-)	-(-)
RIBES MONTIGENUM	3(1)	-(-)	-(-)	-(-)	10(T)	-(-)	-(-)	-(-)	22(2)	3(2)	-(-)
RIBES VISCOSISSIMUM	3(T)	5(T)	18(T)	-(-)	5(T)	-(-)	-(-)	-(-)	4(2)	-(-)	-(-)
ROSA WOODSII +	31(1)	50(1)	64(5)	73(6)	40(1)	60(T)	60(2)	47(1)	8(T)	31(1)	54(1)
RUBUS PARVIFLORUS	5(T)	5(T)	9(5)	-(-)	-(-)	13(T)	10(15)	-(-)	4(5)	9(1)	8(T)
SALIX SCOULERIANA	13(5)	15(3)	9(T)	18(T)	5(3)	13(3)	-(-)	-(-)	8(T)	-(-)	8(5)
SAMBUCUS RACEMOSA +	18(4)	5(T)	9(T)	9(T)	20(1)	7(T)	-(-)	-(-)	27(2)	9(1)	-(-)
SHEPHERDIA CANADENSIS	-(-)	-(-)	100(23)	18(3)	5(4)	7(T)	10(3)	5(T)	8(1)	14(2)	8(3)
SORBUS SCOPULINA	5(22)	-(-)	27(1)	27(7)	20(2)	13(2)	10(T)	-(-)	-(-)	6(T)	-(-)
SPIRAEA BETULIFOLIA	3(5)	-(-)	9(2)	9(10)	-(-)	-(-)	-(-)	-(-)	-(-)	3(T)	-(-)
SYMPHORICARPOS ALBUS	3(5)	10(4)	-(-)	9(3)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	8(4)
SYMPHORICARPOS OREOPHILUS	74(3)	65(2)	82(3)	82(27)	100(29)	93(21)	90(31)	42(7)	53(2)	60(1)	54(1)
VACCINIUM CAESPITOSUM	-(-)	-(-)	9(70)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
GRAMINOIDS											
AGROPYRON TRACHYCAULUM +	33(2)	35(2)	18(T)	36(6)	60(6)	27(12)	100(7)	32(3)	37(6)	57(3)	23([illegible])
BROMUS ANOMALUS	-(-)	-(-)	-(-)	-(-)	-(-)	7(T)	-(-)	47(5)	-(-)	3(5)	-(-)
BROMUS CARINATUS +	72(5)	40(5)	9(1)	36(1)	65(9)	33(3)	60(8)	5(5)	51(5)	31(2)	15(3)
BROMUS CILIATUS	3(7)	5(3)	27(2)	18(T)	5(T)	7(T)	20(3)	26(1)	8(5)	11(1)	23(7)
CALAMAGROSTIS RUBESCENS	13(26)	30(11)	27(3)	9(25)	-(-)	27(15)	-(-)	-(-)	2(T)	3(3)	31(37)
CAREX GEYERI	5(2)	10(3)	9(5)	18(18)	25(8)	40(8)	40(15)	11(29)	2(10)	20(2)	92(14)
CAREX HOODII	21(2)	15(1)	9(T)	9(T)	50(1)	7(T)	10(T)	-(-)	25(2)	20(2)	-(-)
CAREX ROSSII	-(-)	-(-)	27(T)	9(T)	5(T)	33(2)	10(T)	63(5)	12(1)	40(2)	-(-)
DACTYLIS GLOMERATA	-(-)	-(-)	-(-)	-(-)	5(T)	7(T)	10(5)	-(-)	6(T)	6(T)	-(-)
ELYMUS CINEREUS	5(1)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
ELYMUS GLAUCUS	69(15)	60(16)	64(1)	91(4)	45(6)	47(3)	20(24)	11(3)	49(9)	26(4)	23(23)
FESTUCA IDAHOENSIS +	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	10(2)	-(-)	-(-)	9(1)	-(-)
FESTUCA THURBERI	-(-)	-(-)	-(-)	9(17)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
KOELERIA CRISTATA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	10(T)	-(-)	-(-)	-(-)	-(-)
LEUCOPOA KINGII	-(-)	-(-)	-(-)	-(-)	5(T)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
MELICA SPECTABILIS	18(1)	15(1)	9(1)	18(T)	5(T)	13(2)	-(-)	-(-)	29(4)	17(1)	-(-)
PHLEUM ALPINUM	3(T)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	8(1)	-(-)	8(T)
PHLEUM PRATENSE	-(-)	-(-)	-(-)	9(T)	-(-)	13(T)	-(-)	-(-)	8(T)	-(-)	-(-)
POA AMPLA	-(-)	-(-)	18(T)	-(-)	-(-)	7(T)	-(-)	-(-)	2(T)	-(-)	-(-)
POA FENDLERIANA	-(-)	-(-)	-(-)	-(-)	5(T)	-(-)	-(-)	21(2)	-(-)	3(2)	-(-)
POA NERVOSA	13(3)	5(T)	27(1)	9(T)	25(1)	13(4)	20(3)	5(10)	33(4)	26(7)	8(3)
POA PALUSTRIS	5(T)	-(-)	-(-)	-(-)	-(-)	7(T)	-(-)	-(-)	4(1)	-(-)	8(T)
POA PRATENSIS	41(13)	50(9)	-(-)	27(3)	25(28)	27(4)	40(25)	26(5)	18(7)	17(9)	8(T)
SITANION HYSTRIX	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	21(2)	-(-)	-(-)	-(-)
STIPA OCCIDENTALIS +	3(T)	10(10)	-(-)	18(5)	5(T)	20(T)	60(7)	58(3)	10(5)	26(7)	15(T)
TRISETUM SPICATUM	-(-)	-(-)	36(1)	-(-)	10(T)	7(1)	10(T)	16(6)	8(T)	34(T)	15(T)

(con.)

APPENDIX F (Con.)

	POTR/ AMAL/ TALL FORB	POTR/ AMAL/ THFE	POTR- ABLA/ SHCA	POTR- ABLA/ AMAL	POTR- ABLA/ SYOR/ TALL FORB	POTR- ABLA/ SYOR/ THFE	POTR- ABLA/ SYOR/ BRCA	POTR- ABLA/ JUCO	POTR- ABLA/ TALL FORB	POTR- ABLA/ THFE	POTR- ABLA/ CAGE
Number of Stands:	39	20	11	11	20	15	10	19	51	35	13
FORBS											
ACHILLEA MILLEFOLIUM	28(1)	45(1)	45(T)	55(1)	45(1)	73(1)	80(3)	58(2)	59(2)	71(1)	69(2)
ACTAEA RUBRA	5(6)	10(2)	-(-)	-(-)	-(-)	7(T)	-(-)	-(-)	6(26)	3(T)	8(T)
AGASTACHE URTICIFOLIA	79(6)	25(1)	-(-)	36(4)	45(6)	20(1)	30(1)	-(-)	29(2)	9(T)	8(T)
AGOSERIS AURANTIACA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	10(T)	-(-)	-(-)	3(T)	-(-)
AGOSERIS GLAUCA	3(T)	10(T)	-(-)	-(-)	-(-)	13(T)	-(-)	-(-)	-(-)	11(T)	15(T)
ALLIUM BREVISTYLUM	3(T)	-(-)	-(-)	9(T)	5(T)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
ANGELICA PINNATA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	4(1)	-(-)	-(-)
ANTENNARIA MICROPHYLLA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	11(T)	-( )	6(T)	8(T)
APOCYNUM ANDROSAEMIFOLIUM	8(4)	15(3)	-(-)	9(3)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	8(T)
AQUILEGIA COERULEA	5(2)	-(-)	27(2)	18(T)	35(1)	13(T)	20(T)	11(2)	33(T)	17(1)	15(T)
AQUILEGIA FORMOSA	36(4)	-(-)	-(-)	-(-)	-(-)	7(3)	-(-)	-(-)	-(-)	-(-)	-(-)
ARNICA CORDIFOLIA	18(4)	25(12)	82(5)	9(1)	5(3)	33(5)	-(-)	5(T)	18(12)	31(10)	23(1)
ARNICA LATIFOLIA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	10(20)	5(30)	2(10)	6(5)	-(-)
ARTEMISIA LUDOVICIANA	5(1)	-(-)	-(-)	-(-)	5(T)	-(-)	-(-)	-(-)	4(2)	-(-)	-(-)
ASTER CHILENSIS	-(-)	5(T)	-(-)	9(T)	-(-)	-(-)	30(1)	-(-)	-(-)	-(-)	8(T)
ASTER ENGELMANNII	26(4)	30(1)	55(10)	64(2)	65(7)	27(1)	30(1)	-(-)	43(2)	34(T)	15(T)
ASTER FOLIACEUS	5(2)	-(-)	9(2)	-(-)	-(-)	7(2)	-(-)	-(-)	6(2)	-(-)	8(T)
ASTER PERELEGANS	3(T)	-(-)	-(-)	9(2)	-(-)	-(-)	-(-)	-(-)	-(-)	3(T)	15(T)
ASTRAGALUS MISER	3(T)	-(-)	36(8)	-(-)	-(-)	7(2)	20(8)	37(4)	4(1)	14(3)	31(16)
BALSAMORHIZA MACROPHYLLA	-(-)	-(-)	-(-)	-(-)	-(-)	7(3)	10(T)	-(-)	6(21)	3(T)	-(-)
BALSAMORHIZA SAGITTATA	-(-)	5(T)	18(T)	-(-)	5(10)	-(-)	-(-)	-(-)	-(-)	3(T)	-(-)
CALOCHORTUS NUTTALLII	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	10(T)	16(T)	-(-)	-(-)	-(-)
CAMPANULA ROTUNDIFOLIA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	8(T)
CASTILLEJA LINARIAEFOLIA	-(-)	10(T)	-(-)	-(-)	-(-)	7(2)	-(-)	-(-)	-(-)	-(-)	8(T)
CASTILLEJA MINIATA	13(1)	5(T)	9(T)	9(T)	15(2)	-(-)	40(T)	26(T)	12(1)	14(T)	8(3)
CIRSIUM ARVENSE	5(T)	-(-)	-(-)	-(-)	-(-)	7(T)	-(-)	11(3)	4(1)	6(T)	-(-)
CIRSIUM VULGARE	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	8(T)
CLAYTONIA LANCEOLATA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	6(22)	6(1)	-(-)
CORALLORHIZA MACULATA	23(T)	30(1)	9(T)	-(-)	5(T)	13(T)	-(-)	5(T)	-(-)	17(T)	8(T)
DELPHINIUM NUTTALLIANUM	3(T)	-(-)	9(T)	9(T)	10(1)	13(T)	10(1)	-(-)	16(1)	11(T)	-(-)
DELPHINIUM OCCIDENTALE +	15(6)	10(T)	9(T)	9(2)	15(7)	-(-)	-(-)	-(-)	37(4)	9(T)	8(T)
DISPORUM TRACHYCARPUM	8(1)	20(1)	-(-)	27(T)	-(-)	7(T)	-(-)	-(-)	4(T)	3(T)	8(T)
EPILOBIUM ANGUSTIFOLIUM	8(T)	40(2)	82(1)	9(1)	15(T)	20(1)	20(T)	-(-)	6(1)	20(T)	23(1)
EQUISETUM ARVENSE	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	4(1)	-(-)	-(-)
ERIGERON PEREGRINUS	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	5(T)	4(2)	-(-)	8(5)
ERIGERON SPECIOSUS	3(T)	10(T)	-(-)	9(5)	25(2)	13(2)	50(1)	5(T)	14(4)	11(2)	8(T)
FRAGARIA VESCA +	3(1)	20(1)	73(1)	36(2)	40(2)	47(2)	20(2)	47(1)	25(2)	37(2)	38(T)
FRASERA SPECIOSA	5(T)	-(-)	73(1)	36(2)	20(T)	33(1)	30(2)	16(1)	8(3)	20(T)	31(1)
FRITILLARIA ATROPURPUREA	3(T)	-(-)	-(-)	-(-)	5(T)	7(T)	-(-)	-(-)	-(-)	-(-)	-(-)
GALIUM BOREALE	26(5)	20(1)	55(1)	36(1)	5(T)	13(T)	20(1)	5(1)	20(1)	17(T)	31(1)
GERANIUM RICHARDSONII	-(-)	5(T)	9(2)	9(2)	10(15)	13(5)	-(-)	5(T)	24(11)	-(-)	8(T)
GERANIUM VISCOSISSIMUM +	31(4)	40(9)	100(10)	55(2)	45(1)	67(10)	50(1)	21(2)	39(10)	49(5)	38(6)
HABENARIA UNALASCENSIS	5(T)	5(T)	9(T)	-(-)	10(T)	20(T)	-(-)	5(T)	-(-)	9(T)	-(-)
HACKELIA FLORIBUNDA	62(3)	20(1)	18(T)	55(1)	40(3)	13(1)	40(T)	11(T)	39(3)	23(T)	8(T)
HACKELIA PATENS	-(-)	-(-)	-(-)	-(-)	5(1)	-(-)	-(-)	-(-)	2(T)	-(-)	-(-)
HEDYSARUM BOREALE	-(-)	-(-)	45(2)	-(-)	5(T)	-(-)	-(-)	-(-)	4(15)	6(2)	15(2)
HELENIUM HOOPESII	-(-)	-(-)	-(-)	-(-)	5(T)	13(T)	10(1)	11(T)	4(1)	3(T)	8(3)
HELIANTHELLA UNIFLORA	3(T)	10(T)	27(1)	-(-)	5(10)	-(-)	-(-)	-(-)	10(4)	3(1)	15(T)
HERACLEUM LANATUM	10(8)	10(T)	-(-)	9(T)	10(2)	-(-)	-(-)	-(-)	16(13)	-(-)	-(-)
HIERACIUM ALBIFLORUM	-(-)	-(-)	-(-)	27(1)	-(-)	7(T)	10(3)	-(-)	2(T)	9(T)	15(T)
HIERACIUM CYNOGLOSSOIDES	-(-)	10(T)	-(-)	-(-)	-(-)	-(-)	10(T)	-(-)	-(-)	3(T)	8(T)
HYDROPHYLLUM CAPITATUM	18(T)	30(1)	9(T)	9(T)	35(T)	13(T)	10(1)	-(-)	27(1)	26(1)	-(-)
LATHYRUS LANSZWERTII	10(10)	15(20)	-(-)	18(12)	20(11)	20(4)	70(33)	16(22)	25(10)	34(31)	15(21)
LATHYRUS LEUCANTHUS	13(7)	-(-)	-(-)	27(39)	10(12)	27(22)	10(T)	-(-)	14(14)	11(29)	38(16)
LATHYRUS PAUCIFLORUS	5(5)	-(-)	-(-)	9(T)	25(1)	-(-)	-(-)	-(-)	4(T)	6(T)	-(-)
LIGUSTICUM FILICINUM	3(8)	5(25)	45(4)	-(-)	-(-)	-(-)	-(-)	-(-)	24(18)	11(T)	8(15)
LUPINUS ARGENTEUS	15(3)	30(6)	73(3)	9(7)	25(2)	40(8)	10(3)	21(5)	18(1)	31(7)	38(5)
LUPINUS CAUDATUS	-(-)	-(-)	-(-)	18(4)	5(1)	-(-)	10(1)	-(-)	-(-)	-(-)	-(-)
LUPINUS LAXIFLORUS	5(T)	5(1)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	2(10)	6(10)	-(-)
MERTENSIA ARIZONICA +	13(13)	-(-)	-(-)	9(3)	40(6)	20(2)	20(T)	11(2)	27(9)	6(T)	-(-)
MERTENSIA LONGIFLORA	3(T)	5(T)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	4(21)	-(-)	-(-)
OSMORHIZA CHILENSIS +	64(7)	90(14)	82(2)	64(2)	45(2)	67(2)	40(2)	16(1)	71(5)	69(5)	54(2)
OSMORHIZA OCCIDENTALIS	44(11)	15(1)	18(1)	18(5)	30(3)	7(T)	10(T)	-(-)	35(8)	14(T)	-(-)
PAEONIA BROWNII	13(1)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
PENSTEMON WATSONI	3(T)	5(T)	-(-)	-(-)	-(-)	-(-)	-(-)	5(1)	-(-)	-(-)	-(-)

(con.)

APPENDIX F (Con.)

	POTR/ AMAL/ TALL FORB	POTR/ AMAL/ THFE	POTR- ABLA/ SHCA	POTR- ABLA/ AMAL	POTR- ABLA/ SYOR/ TALL FORB	POTR- ABLA/ SYOR/ THFE	POTR- ABLA/ SYOR/ BRCA	POTR- ABLA/ JUCO	POTR ABLA/ TALL FORB	POTR- ABLA/ THFE	POTR- ABLA/ CAGE
Number of Stands:	39	20	11	11	20	15	10	19	51	35	13
PERIDERIDIA GAIRDNERI	8(T)	20(T)	18(T)	-( )	( )	(-)	-(-)	(-)	4(3)	-(-)	-( )
PHACELIA HETEROPHYLLA	8(T)	10(T)	-(-)	(-)	25(T)	-( )	20(1)	-(-)	12(1)	3(T)	( )
POLEMONIUM FOLIOSISSIMUM +	15(1)	-(-)	( )	9(T)	25(4)	(-)	10(T)	( )	18(1)	6(2)	( )
POTENTILLA DIVERSIFOLIA	-(-)	-( )	( )	-(-)	-( )	( )	( )	16(2)	-(-)	( )	( )
POTENTILLA GLANDULOSA	13(T)	10(T)	27(T)	(-)	15(T)	27(2)	10(2)	-(-)	27(1)	29(1)	8(T)
POTENTILLA GRACILIS	8(T)	-( )	27(1)	-( )	10(3)	( )	( )	16(T)	6(T)	23(1)	15(T)
RANUNCULUS INAMOENUS	3(T)	-(-)	( )	-(-)	-(-)	7(T)	( )	5(T)	8(T)	6(T)	( )
RUDBECKIA OCCIDENTALIS	18(4)	15(4)	-(-)	36(1)	55(9)	20(1)	30(1)	(-)	71(13)	26(1)	8(T)
SCROPHULARIA LANCEOLATA	13(T)	5(T)	( )	-(-)	20(3)	( )	(-)	(-)	10(T)	(-)	( )
SENECIO CRASSULUS	-(-)	-(-)	18(T)	-(-)	-( )	( )	( )	-(-)	16(1)	6(4)	-( )
SENECIO CYMBALARIOIDES	3(T)	10(3)	-(-)	-(-)	25(1)	( )	10(T)	-( )	8(1)	11(1)	8(T)
SENECIO INTEGERRIMUS	5(3)	10(2)	( )	( )	-(-)	7(T)	10(T)	-(-)	-(-)	6(T)	( )
SENECIO SERRA +	67(7)	35(1)	(-)	64(4)	50(6)	-(-)	40(1)	( )	35(3)	14(1)	( )
SENECIO STREPTANTHIFOLIUS	( )	-( )	9(T)	18(2)	5(T)	-(-)	10(T)	( )	-(-)	-(-)	-(-)
SIDALCEA OREGANA	3(T)	5(T)	( )	( )	5(3)	13(T)	-(-)	(-)	-(-)	-(-)	-(-)
SILENE MENZIESII	3(3)	5(2)	9(T)	18(1)	30(T)	7(T)	10(T)	( )	8(T)	14(2)	23(T)
SMILACINA RACEMOSA	46(5)	35(5)	( )	27(T)	-( )	20(T)	-(-)	-(-)	6(T)	11(T)	8(T)
SMILACINA STELLATA	31(3)	60(6)	9(T)	36(T)	25(1)	20(4)	30(1)	-(-)	10(3)	14(1	38(2)
STELLARIA JAMESIANA	64(2)	45(2)	9(T)	45(1)	45(2)	47(1)	30(2)	5(5)	55(2)	51(3)	23(T)
TARAXACUM OFFICINALE	31(2)	45(1)	18(10)	36(T)	45(T)	40(1)	50(2)	53(6)	59(2)	46(3)	54(2)
THALICTRUM FENDLERI +	72(18)	75(12)	91(13)	91(6)	85(11)	93(11)	70(1)	47(5)	69(8)	74(6)	77(6)
THERMOPSIS MONTANA	( )	5(10)	-( )	-(-)	5(2)	7(T)	-(-)	(-)	(-)	( )	8(13)
TRAGOPOGON DUBIUS	3(T)	10(T)	( )	( )	-( )	( )	10(T)	-(-)	2(T)	6(T)	( )
TRIFOLIUM GYMNOCARPON	( )	-(-)	-( )	-(-)	-( )	-(-)	-( )	5(20)	-(-)	( )	(-)
TRIFOLIUM LONGIPES	-( )	-(-)	9(2)	-(-)	-( )	(-)	10(5)	21(4)	22(28)	9(9)	(-)
URTICA DIOICA	5(3)	5(T)	-( )	-(-)	-(-)	-(-)	-( )	-(-)	2(3)	( )	-(-)
VALERIANA OCCIDENTALIS	44(4)	20(2)	18(2)	27(3)	65(7)	40(1)	10(T)	( )	61(6)	14(1)	8(T)
VERBASCUM THAPSUS	3(T)	-( )	-(-)	( )	-( )	(-)	-(-)	-(-)	2(T)	( )	(-)
VICIA AMERICANA	15(2)	10(T)	(-)	-(-)	40(4)	13(2)	30(4)	21(9)	18(9)	9(3)	31(4
VIGUIERA MULTIFLORA	3(T)	( )	( )	( )	5(T)	-( )	20(2)	5(T)	-( )	3(4)	-(-)
VIOLA ADUNCA	8(3)	20(T)	64(T)	36(1)	25(1)	13(1)	10(1)	11(1)	10(2)	20(1)	38(1
VIOLA NUTTALLII	18(2)	15(5)	9(T)	9(T)	10(1)	27(1)	10(T)	-(-)	29(3)	34(1)	( )
VIOLA PURPUREA	-( )	5(1)	(-)	-(-)	( )	(-)	( )	(-)	( )	3(T)	( )
WYETHIA AMPLEXICAULIS	5(1)	( )	27(1)	-(-)	-( )	13(1)	-(-)	-(-)	6(2)	3(T)	8(T)
ANNUALS											
ANDROSACE SEPTENTRIONALIS	(-)	-(-)	( )	-(-)	-(-)	( )	)	5(T)	14(1	( )	-( )
CHENOPODIUM FREMONTII	10(T)	5(T)	( )	9(T)	15(T)	-( )	( )	( )	4(.)	( )	( )
COLLINSIA PARVIFLORA	3(3)	5(2)	9(T	9(T)	10(2)	13(3)	20(9)	-(-)	8(11)	14(2)	( )
COLLOMIA LINEARIS	13(1)	5(T)	( )	( )	5(T)	(	20(2)	-(-)	24 2)	9(2)	8(T)
DESCURAINIA RICHARDSONII	21(1)	-( )	( )	18(1)	25(1)	-( )	30(T)	5(T)	33(1)	9(T)	15(T)
GALIUM APARINE	31(13)	20(1)	(	-)	10(19)	-( )	.)	(-)	-(-)	(	)
GALIUM BIFOLIUM	36(7)	15(1)	9(T)	( )	5(3)	13(2)	20(2)	(-)	14(8)	17(6)	( )
NEMOPHILA BREVIFLORA	28(15)	25(5)	(-)	9(2)	25(12)	(-)	10(60)	( )	[illegible]	4(4)	( )
POLYGONUM DOUGLASII	31(1)	10(T)	( )	9(T)	10(T)	-( )	10(10)	(-)	12(8	11(T	8 .)

(con.)

APPENDIX F (Con.)

	POTR-ABLA/CARO	POTR-PICO/SYOR	POTR-PICO/JUCO	POTR-PICO/THFE	POTR-PICO/CAGE	POTR-PSME/AMAL	POTR-PSME/SYOR	POTR-PSME/JUCO	POTR-PSME/CARU	POTR-ABCO/SYOR	POTR-ABCO/ARPA
Number of Stands:	46	14	23	7	17	18	15	13	7	32	7
TREES											
ABIES CONCOLOR	2(15)	-(-)	-(-)	-(-)	-(-)	11(1)	13(7)	38(16)	-(-)	100(26)	100(30)
ABIES LASIOCARPA	93(26)	43(2)	17(2)	71(3)	41(2)	28(2)	27(3)	23(2)	29(T)	3(2)	-(-)
PICEA ENGELMANNII	63(15)	-(-)	-(-)	-(-)	12(1)	-(-)	-(-)	8(5)	14(T)	6(3)	14(1)
PICEA PUNGENS	2(T)	14(T)	13(1)	14(3)	6(3)	-(-)	-(-)	15(8)	-(-)	3(T)	-(-)
PINUS CONTORTA	2(T)	100(22)	100(20)	100(27)	100(27)	17(T)	13(6)	8(6)	29(T)	-(-)	-(-)
PINUS FLEXILIS	26(4)	-(-)	9(6)	-(-)	6(T)	-(-)	7(T)	23(4)	43(1)	9(2)	71(10)
PINUS PONDEROSA	4(1)	-(-)	4(14)	-(-)	-(-)	-(-)	-(-)	23(10)	-(-)	3(T)	-(-)
POPULUS TREMULOIDES	100(58)	100(55)	100(54)	100(47)	100(57)	100(60)	100(63)	100(62)	100(65)	100(60)	100(50)
POPULUS TREMULOIDES (reprod.)	89(2)	64(8)	70(4)	43(4)	82(6)	56(4)	80(3)	69(1)	43(14)	78(2)	100(2)
PSEUDOTSUGA MENZIESII	11(2)	21(6)	13(10)	14(5)	35(12)	100(20)	100(16)	100(16)	100(16)	22(2)	57(15)
SHRUBS											
ACER GLABRUM	-(-)	7(1)	-(-)	-(-)	-(-)	6(3)	13(8)	-(-)	-(-)	-(-)	-(-)
ACER GRANDIDENTATUM	2(T)	-(-)	-(-)	-(-)	-(-)	22(35)	33(1)	-(-)	-(-)	6(2)	-(-)
AMELANCHIER ALNIFOLIA	7(1)	64(15)	17(1)	57(2)	29(T)	94(19)	47(3)	38(1)	43(1)	25(T)	14(T)
ARCTOSTAPHYLOS PATULA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	8(5)	-(-)	9(1)	100(23)
ARCTOSTAPHYLOS UVA-URSI	-(-)	-(-)	39(10)	14(1)	12(8)	-(-)	-(-)	15(T)	-(-)	3(T)	-(-)
ARTEMISIA TRIDENTATA	2(1)	-(-)	17(7)	14(T)	6(T)	-(-)	7(T)	23(1)	-(-)	6(T)	-(-)
BERBERIS REPENS	30(2)	43(3)	61(7)	57(3)	59(2)	67(14)	53(8)	77(10)	57(2)	47(5)	71(3)
CEANOTHUS VELUTINUS	-(-)	7(2)	-(-)	14(1)	12(5)	6(T)	-(-)	-(-)	-(-)	-(-)	-(-)
CERCOCARPUS LEDIFOLIUS	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	3(T)	29(4)
CHRYSOTHAMNUS VISCIDIFLORUS	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	7(T)	8(T)	-(-)	-(-)	-(-)
JUNIPERUS COMMUNIS	28(1)	36(3)	100(16)	43(1)	47(2)	-(-)	-(-)	92(13)	-(-)	9(2)	29(1)
LONICERA INVOLUCRATA	-(-)	7(T)	-(-)	29(T)	-(-)	-(-)	-(-)	-(-)	14(2)	-(-)	-(-)
PACHISTIMA MYRSINITES	-(-)	36(8)	17(1)	86(1)	29(1)	61(5)	27(1)	8(T)	14(1)	16(1)	-(-)
PHYSOCARPUS MALVACEUS	-(-)	-(-)	-(-)	-(-)	-(-)	17(2)	7(T)	-(-)	-(-)	3(T)	-(-)
PRUNUS VIRGINIANA	-(-)	21(7)	4(T)	14(2)	-(-)	56(24)	33(1)	-(-)	-(-)	3(T)	-(-)
QUERCUS GAMBELII	2(13)	-(-)	-(-)	-(-)	-(-)	11(1)	-(-)	-(-)	-(-)	3(5)	-(-)
RIBES CEREUM	2(T)	-(-)	-(-)	-(-)	-(-)	6(T)	20(2)	-(-)	-(-)	-(-)	-(-)
RIBES LACUSTRE	-(-)	-(-)	-(-)	14(2)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
RIBES MONTIGENUM	7(T)	-(-)	(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	3(T)	-(-)
RIBES VISCOSISSIMUM	-(-)	-(-)	-(-)	14(T)	-(-)	11(1)	-(-)	-(-)	-(-)	-(-)	-(-)
ROSA WOODSII +	24(1)	71(7)	57(T)	71(1)	35(1)	78(2)	87(1)	31(T)	43(2)	56(1)	-(-)
RUBUS PARVIFLORUS	-(-)	7(T)	-(-)	14(1)	6(T)	11(3)	-(-)	8(T)	-(-)	-(-)	-(-)
SALIX SCOULERIANA	-(-)	-(-)	-(-)	14(1)	6(T)	56(4)	13(T)	-(-)	-(-)	-(-)	-(-)
SAMBUCUS RACEMOSA +	2(T)	-(-)	-(-)	-(-)	-(-)	-(-)	13(T)	-(-)	-(-)	3(T)	14(T)
SHEPHERDIA CANADENSIS	2(1)	14(1)	17(11)	14(T)	12(5)	6(4)	13(1)	8(T)	29(4)	-(-)	-(-)
SORBUS SCOPULINA	-(-)	7(1)	-(-)	-(-)	-(-)	28(1)	7(5)	-(-)	-(-)	-(-)	-(-)
SPIRAEA BETULIFOLIA	-(-)	7(T)	-(-)	-(-)	-(-)	22(16)	13(39)	-(-)	-(-)	-(-)	-(-)
SYMPHORICARPOS ALBUS	-(-)	21(12)	-(-)	-(-)	18(4)	28(6)	13(25)	-(-)	14(5)	-(-)	-(-)
SYMPHORICARPOS OREOPHILUS	33(1)	64(24)	39(4)	57(T)	24(1)	67(15)	87(30)	77(8)	43(3)	100(24)	29(6)
VACCINIUM CAESPITOSUM	-(-)	-(-)	-(-)	29(2)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
GRAMINOIDS											
AGROPYRON SPICATUM	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	8(1)	-(-)	-(-)	-(-)
AGROPYRON TRACHYCAULUM +	39(2)	43(3)	48(3)	57(2)	29(2)	33(1)	47(4)	62(1)	29(1)	56(2)	-(-)
BROMUS ANOMALUS	30(6)	-(-)	-(-)	-(-)	-(-)	-(-)	7(5)	31(2)	-(-)	19(6)	14(1)
BROMUS CARINATUS +	13(2)	7(10)	13(T)	29(1)	18(2)	17(22)	33(11)	-(-)	14(T)	38(4)	-(-)
BROMUS CILIATUS	7(2)	14(2)	35(2)	14(T)	18(2)	-(-)	7(1)	23(1)	29(7)	13(4)	14(T)
CALAMAGROSTIS RUBESCENS	2(T)	57(31)	-(-)	-(-)	41(56)	50(12)	60(33)	-(-)	100(41)	-(-)	-(-)
CAREX GEYERI	2(T)	43(11)	65(9)	43(3)	88(21)	22(22)	13(52)	15(4)	29(18)	6(1)	-(-)
CAREX HOODII	4(T)	7(T)	-(-)	-(-)	-(-)	-(-)	20(5)	-(-)	14(T)	3(T)	-(-)
CAREX ROSSII	85(3)	-(-)	9(T)	43(1)	6(T)	-(-)	-(-)	46(4)	-(-)	19(7)	100(2)
DACTYLIS GLOMERATA	4(T)	-(-)	-(-)	-(-)	-(-)	-(-)	13(19)	-(-)	-(-)	16(3)	-(-)
ELYMUS GLAUCUS	-(-)	64(4)	4(T)	71(10)	24(1)	83(11)	67(15)	8(10)	71(3)	19(7)	-(-)
FESTUCA IDAHOENSIS +	20(T)	-(-)	17(7)	14(5)	6(T)	-(-)	7(T)	8(T)	14(T)	-(-)	-(-)
FESTUCA THURBERI	7(1)	-(-)	(-)	-(-)	-(-)	6(T)	-(-)	-(-)	-(-)	3(8)	-(-)
HORDEUM JUBATUM	-(-)	-(-)	4(T)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
KOELERIA CRISTATA	11(1)	-(-)	-(-)	14(T)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
LEUCOPOA KINGII	-(-)	-(-)	4(1)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
MELICA SPECTABILIS	9(1)	7(T)	4(T)	14(T)	18(1)	6(T)	20(1)	8(T)	14(T)	13(1)	-(-)
PHLEUM ALPINUM	7(T)	-(-)	-(-)	29(1)	-(-)	-(-)	-(-)	-(-)	14(3)	-(-)	-(-)
PHLEUM PRATENSE	-(-)	14(T)	-(-)	-(-)	-(-)	-(-)	7(T)	-(-)	29(T)	3(T)	-(-)
POA AMPLA	-(-)	-(-)	9(T)	14(5)	-(-)	-(-)	-(-)	-(-)	14(1)	-(-)	-(-)
POA FENDLERIANA	17(3)	-(-)	13(1)	-(-)	6(10)	-(-)	-(-)	23(4)	-(-)	6(2)	57(1)
POA NERVOSA	11(2)	7(1)	9(1)	29(T)	24(T)	6(1)	13(T)	15(2)	29(1)	16(4)	29(1)
POA PALUSTRIS	2(2)	7(T)	-(-)	-(-)	-(-)	-(-)	7(T)	-(-)	-(-)	-(-)	-(-)
POA PRATENSIS	17(12)	43(8)	26(7)	14(T)	12(T)	17(T)	40(5)	38(6)	14(3)	19(7)	-(-)
SITANION HYSTRIX	26(2)	-(-)	9(T)	-(-)	-(-)	-(-)	7(5)	54(1)	-(-)	3(T)	14(T)
STIPA COMATA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	8(T)	-(-)	-(-)	-(-)
STIPA OCCIDENTALIS +	35(4)	21(3)	65(6)	14(3)	29(1)	11(5)	13(2)	54(4)	14(T)	34(10)	-(-)
TRISETUM SPICATUM	17(T)	7(1)	35(1)	43(3)	24(T)	-(-)	7(T)	8(T)	14(T)	3(T)	-(-)

(con.)

	POTR- ABLA/ CARO	POTR- PICO/ SYOR	POTR- PICO/ JUCO	POTR- PICO/ THFE	POTR- PICO/ CAGE	POTR- PSME/ AMAL	POTR- PSME/ SYOR	POTR- PSME/ JUCO	POTR- PSME/ CARU	POTR- ABCO/ SYOR	POTR- ABCO/ ARPA
Number of Stands:	46	14	23	7	17	18	15	13	7	32	7
FORBS											
ACHILLEA MILLEFOLIUM	74(2)	86(2)	83(2)	86(1)	82(2)	50(T)	80(1)	31(1)	71(1)	47(1)	14(2)
ACONITUM COLUMBIANUM	-(-)	-(-)	-(-)	14(1)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
ACTAEA RUBRA	-(-)	-(-)	-(-)	14(1)	-(-)	6(T)	13(T)	-(-)	14(T)	-(-)	(-)
AGASTACHE URTICIFOLIA	-(-)	-(-)	4(3)	-(-)	-(-)	11(2)	40(4)	-(-)	-(-)	22(4)	-(-)
AGOSERIS AURANTIACA	4(T)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
AGOSERIS GLAUCA	7(T)	14(T)	4(T)	-(-)	35(T)	-(-)	-(-)	8(T)	-(-)	3(T)	-(-)
ALLIUM BREVISTYLUM	-(-)	-(-)	4(T)	-(-)	6(13)	-(-)	-(-)	-(-)	-(-)	-(-)	-( )
ANTENNARIA MICROPHYLLA	17(T)	14(T)	43(3)	29(8)	35(T)	-(-)	-(-)	8(T)	-(-)	9(2)	-(-)
APOCYNUM ANDROSAEMIFOLIUM	-(-)	7(T)	-(-)	-(-)	-(-)	-(-)	7(T)	-(-)	-(-)	-(-)	-(-)
AQUILEGIA COERULEA	4(T)	-(-)	17(T)	29(1)	12(2)	6(T)	7(1)	8(T)	-(-)	16(T)	-(-)
ARNICA CORDIFOLIA	13(4)	29(9)	9(3)	29(3)	41(5)	44(17)	33(7)	8(4)	71(16)	3(1)	14(4)
ARNICA LATIFOLIA	-(-)	7(10)	52(7)	14(10)	18(17)	-(-)	-(-)	15(8)	-(-)	-(-)	-(-)
ARTEMISIA LUDOVICIANA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	8(T)	-(-)	-(-)	-(-)
ASTER CHILENSIS	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	13(T)	-(-)	-(-)	-(-)	-(-)
ASTER ENGELMANNII	2(T)	7(2)	4(T)	14(2)	18(1)	50(4)	40(2)	-(-)	14(5)	25(2)	-(-)
ASTER FOLIACEUS	2(T)	7(5)	-(-)	-(-)	12(2)	-(-)	-(-)	-(-)	14(1)	3(T)	-(-)
ASTRAGALUS MISER	35(6)	14(10)	65(13)	14(3)	29(24)	-(-)	-(-)	31(6)	71(8)	3(T)	-(-)
BALSAMORHIZA MACROPHYLLA	-(-)	7(20)	-(-)	-(-)	-(-)	6(T)	-(-)	-(-)	14(T)	-(-)	-(-)
BALSAMORHIZA SAGITTATA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	3(T)	-(-)
CALOCHORTUS NUTTALLII	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	13(T)	8(T)	(-)	3(T)	-(-)
CAMPANULA ROTUNDIFOLIA	2(2)	7(2)	9(T)	14(T)	18(T)	-(-)	-(-)	-(-)	43(T)	-(-)	-(-)
CASTILLEJA LINARIAEFOLIA	-(-)	29(1)	4(T)	-(-)	18(T)	6(T)	7(T)	-(-)	14(T)	-(-)	-(-)
CASTILLEJA MINIATA	17(T)	14(5)	22(1)	14(T)	29(1)	6(T)	7(T)	-(-)	14(T)	-(-)	43(T)
CIRSIUM ARVENSE	9(4)	-(-)	-(-)	-(-)	-(-)	-(-)	7(T)	8(T)	-(-)	13(T)	-(-)
CLAYTONIA LANCEOLATA	4(T)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
CORALLORHIZA MACULATA	4(T)	-(-)	-(-)	-(-)	12(T)	11(T)	7(T)	8(T)	-(-)	-(-)	29(T)
CREPIS ACUMINATA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	3(T)	-(-)
DELPHINIUM NUTTALLIANUM	4(T)	-(-)	-(-)	-(-)	12(2)	6(T)	7(T)	-(-)	-(-)	-(-)	-(-)
DELPHINIUM OCCIDENTALE +	2(T)	-(-)	-(-)	-(-)	-(-)	6(T)	20(2)	-(-)	14(T)	6(8)	-(-)
DISPORUM TRACHYCARPUM	2(T)	7(T)	-(-)	14(T)	-(-)	33(T)	-(-)	-(-)	-(-)	-(-)	(-)
EPILOBIUM ANGUSTIFOLIUM	17(T)	21(10)	4(2)	-(-)	29(T)	22(1)	20(4)	-(-)	57(14)	-(-)	(-)
EQUISETUM ARVENSE	-(-)	-(-)	-(-)	14(1)	-(-)	-(-)	-(-)	-(-)	-(-)	-( )	-(-)
ERIGERON FLAGELLARIS	2(T)	-(-)	-(-)	-(-)	6(T)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
ERIGERON PEREGRINUS	2(T)	14(10)	30(4)	14(T)	6(1)	-(-)	-(-)	8(10)	14(T)	-(-)	-(-)
ERIGERON SPECIOSUS	2(T)	29(3)	17(1)	-(-)	6(T)	11(T)	27(1)	-(-)	14(T)	9(T)	-(-)
FRAGARIA VESCA +	48(1)	64(3)	43(3)	86(T)	41(5)	50(2)	40(3)	15(8)	100(1)	9(3)	-(-)
FRASERA SPECIOSA	9(T)	21(T)	26(2)	-(-)	18(2)	-(-)	13(T)	8(2)	14(T)	31(1)	-(-)
FRITILLARIA ATROPURPUREA	2(T)	7(T)	-(-)	-(-)	6(T)	-(-)	7(T)	-(-)	-(-)	-( )	(-)
GALIUM BOREALE	-(-)	36(T)	52(1)	43(1)	24(T)	28(1)	20(4)	8(T)	57(1)	16(1)	(-)
GERANIUM RICHARDSONII	2(T)	14(1)	4(T)	14(10)	12(2)	-(-)	13(16)	-(-)	-(-)	3(2)	-( )
GERANIUM VISCOSISSIMUM +	4(3)	71(15)	70(2)	57(3)	47(10)	61(4)	73(12)	8(T)	86(6)	16(3)	( )
HABENARIA UNALASCENSIS	2(T)	21(T)	-(-)	14(T)	18(T)	17(T)	13(T)	-(-)	-(-)	-(-)	-(-)
HACKELIA FLORIBUNDA	-(-)	7(5)	4(T)	-(-)	6(T)	6(T)	27(1)	-(-)	-(-)	16(2)	-(-)
HEDYSARUM BOREALE	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	14(15)	-(-)	-(-)
HELENIUM HOOPESII	4(3)	-(-)	-(-)	14(T)	-(-)	-(-)	7(T)	-(-)	-(-)	3(T)	-(-)
HELIANTHELLA UNIFLORA	9(T)	-(-)	9(T)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-( )	-(-)
HERACLEUM LANATUM	-(-)	7(1)	-(-)	-(-)	-(-)	-(-)	7(20)	-( )	-(-)	-(-)	-(-)
HIERACIUM ALBIFLORUM	-(-)	14(T)	9(T)	-(-)	18(T)	-(-)	-(-)	-(-)	-(-)	-(-)	(-)
HIERACIUM CYNOGLOSSOIDES	-(-)	14(T)	-(-)	-(-)	18(1)	17(T)	20(T)	-(-)	14(T)	-(-)	-( )
HYDROPHYLLUM CAPITATUM	-(-)	-(-)	-(-)	-(-)	6(T)	17(1)	-(-)	-(-)	-(-)	-(-)	-(-)
LATHYRUS LANSZWERTII	2(T)	14(5)	22(12)	29(26)	18(15)	11(12)	13(23)	-(-)	-(-)	22(21)	-(-)
LATHYRUS LEUCANTHUS	7(6)	-(-)	-(-)	14(25)	-(-)	11(49)	20(28)	31(26)	(-)	6(28)	(-)
LATHYRUS PAUCIFLORUS	-(-)	7(T)	-(-)	-(-)	-(-)	-(-)	7(3)	-(-)	-(-)	13(2)	-(-)
LIGUSTICUM FILICINUM	15(T)	21(2)	-(-)	14(T)	18(6)	-(-)	20(9)	-(-)	(-)	-(-)	-(-)
LUPINUS ARGENTEUS	30(8)	79(5)	52(6)	29(3)	71(5)	33(5)	53(4)	31(1)	86(2)	16(1)	-(-)
LUPINUS CAUDATUS	-(-)	-(-)	-(-)	14(T)	-(-)	6(T)	-(-)	-(-)	-(-)	( )	-(-)
LUPINUS LAXIFLORUS	2(5)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	22(2)	29(4)
MERTENSIA ARIZONICA +	13(1)	-(-)	-(-)	14(T)	-(-)	-(-)	-(-)	-(-)	-(-)	19(5)	(-)
MERTENSIA LONGIFLORA	-(-)	-(-)	-(-)	-(-)	-(-)	17(T)	-(-)	-(-)	-( )	-(-)	-(-)
OSMORHIZA CHILENSIS +	13(1)	64(3)	22(T)	100(2)	59(3)	78(5)	87(4)	15(T)	86(3)	63(3)	-(-)
OSMORHIZA OCCIDENTALIS	2(T)	14(1)	-(-)	-(-)	-(-)	11(9)	27(T)	-(-)	-(-)	13(1)	-(-)
PENSTEMON WATSONI	4(T)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	( )	22(1)	43(1)

(con.)

APPENDIX F (Con.)

	POTR-ABLA/CARO	POTR-PICO/SYOR	POTR-PICO/JUCO	POTR-PICO/THFE	POTR-PICO/CAGE	POTR-PSME/AMAL	POTR-PSME/SYOR	POTR-PSME/JUCO	POTR-PSME/CARU	POTR-ABCO/SYOR	POTR-ABCO/ARPA
Number of Stands:	46	14	23	7	17	18	15	13	7	32	7
PERIDERIDIA GAIRDNERI	-(-)	43(1)	-(-)	-(-)	18(2)	22(T)	7(T)	-(-)	43(1)	-(-)	-(-)
PHACELIA HETEROPHYLLA	2(T)	-(-)	-(-)	-(-)	6(T)	-(-)	13(T)	-(-)	-(-)	3(T)	-(-)
POLEMONIUM FOLIOSISSIMUM +	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	7(T)	-(-)	-(-)	6(T)	-(-)
POTENTILLA DIVERSIFOLIA	2(T)	-(-)	-(-)	-(-)	6(T)	-(-)	-(-)	15(T)	-(-)	-(-)	-(-)
POTENTILLA GLANDULOSA	2(T)	57(1)	4(T)	14(1)	12(3)	17(T)	20(T)	-(-)	57(T)	-(-)	-(-)
POTENTILLA GRACILIS	17(1)	29(1)	30(T)	29(T)	24(2)	-(-)	13(T)	15(T)	29(T)	-(-)	-(-)
PTERIDIUM AQUILINUM	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	7(35)	-(-)	-(-)	-(-)	-(-)
RANUNCULUS INAMOENUS	9(T)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
RUDBECKIA OCCIDENTALIS	-(-)	14(1)	-(-)	-(-)	-(-)	17(1)	33(1)	-(-)	-(-)	25(3)	-(-)
SCROPHULARIA LANCEOLATA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	9(T)	-(-)
SENECIO CRASSULUS	9(1)	-(-)	-(-)	-(-)	-(-)	-(-)	7(T)	-(-)	-(-)	-(-)	-(-)
SENECIO CYMBALARIOIDES	-(-)	7(T)	-(-)	-(-)	-(-)	-(-)	13(T)	-(-)	-(-)	9(T)	-(-)
SENECIO INTEGERRIMUS	9(1)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
SENECIO SERRA +	-(-)	-(-)	-(-)	29(T)	-(-)	-(-)	20(1)	8(2)	14(T)	13(4)	-(-)
SENECIO STREPTANTHIFOLIUS	-(-)	-(-)	4(T)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
SIDALCEA OREGANA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	7(T)	-(-)	-(-)	-(-)	-(-)
SILENE MENZIESII	-(-)	-(-)	9(T)	14(T)	6(T)	44(T)	13(T)	-(-)	-(-)	-(-)	-(-)
SMILACINA RACEMOSA	-(-)	-(-)	-(-)	-(-)	6(T)	39(1)	20(T)	-(-)	29(T)	-(-)	-(-)
SMILACINA STELLATA	2(T)	21(1)	9(T)	14(T)	18(T)	39(2)	33(1)	15(T)	-(-)	3(1)	-(-)
STELLARIA JAMESIANA	20(2)	29(3)	9(T)	43(T)	24(T)	11(1)	33(1)	8(1)	-(-)	63(1)	57(1)
TARAXACUM OFFICINALE	65(1)	57(2)	52(4)	43(4)	35(3)	33(T)	40(1)	38(8)	57(2)	41(2)	-(-)
THALICTRUM FENDLERI +	24(2)	79(8)	48(8)	57(8)	41(10)	83(13)	87(10)	62(1)	86(8)	34(4)	-(-)
THERMOPSIS MONTANA	-(-)	-(-)	9(4)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	3(T)	-(-)
TRAGOPOGON DUBIUS	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	7(T)	-(-)	-(-)	-(-)	-(-)
TRIFOLIUM GYMNOCARPON	7(13)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	19(2)	29(9)
TRIFOLIUM LONGIPES	26(20)	-(-)	17(11)	29(5)	6(T)	-(-)	-(-)	-(-)	-(-)	3(T)	-(-)
VALERIANA OCCIDENTALIS	-(-)	21(1)	-(-)	-(-)	-(-)	11(T)	53(3)	-(-)	29(3)	22(4)	-(-)
VERATRUM CALIFORNICUM	-(-)	-(-)	-(-)	14(4)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
VICIA AMERICANA	9(8)	14(T)	-(-)	-(-)	6(T)	6(2)	20(2)	8(25)	-(-)	25(7)	-(-)
VIGUIERA MULTIFLORA	2(T)	7(T)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	3(T)	-(-)
VIOLA ADUNCA	2(T)	7(1)	-(-)	14(T)	18(T)	17(1)	13(4)	-(-)	14(T)	13(1)	-(-)
VIOLA NUTTALLII	2(1)	14(1)	-(-)	-(-)	12(T)	6(T)	7(T)	8(1)	-(-)	6(1)	-(-)
VIOLA PURPUREA	2(T)	-(-)	-(-)	29(1)	-(-)	-(-)	-(-)	-(-)	-(-)	3(T)	-(-)
WYETHIA AMPLEXICAULIS	-(-)	7(T)	-(-)	-(-)	-(-)	6(1)	7(T)	-(-)	-(-)	3(1)	-(-)
ANNUALS											
ANDROSACE SEPTENTRIONALIS	9(T)	-(-)	-(-)	-(-)	-(-)	-(-)	7(T)	-(-)	-(-)	-(-)	-(-)
CHENOPODIUM FREMONTII	2(T)	-(-)	-(-)	-(-)	6(T)	-(-)	7(T)	-(-)	-(-)	6(T)	-(-)
COLLINSIA PARVIFLORA	4(T)	-(-)	-(-)	14(T)	6(T)	11(T)	13(3)	8(1)	14(3)	-(-)	-(-)
COLLOMIA LINEARIS	2(T)	-(-)	-(-)	-(-)	6(5)	-(-)	7(2)	-(-)	-(-)	13(T)	-(-)
DESCURAINIA RICHARDSONII	9(T)	-(-)	-(-)	-(-)	6(T)	-(-)	13(T)	8(T)	-(-)	16(T)	-(-)
GALIUM APARINE	-(-)	-(-)	-(-)	-(-)	-(-)	6(T)	-(-)	-(-)	-(-)	-(-)	-(-)
GALIUM BIFOLIUM	7(T)	7(T)	-(-)	14(T)	6(T)	17(1)	7(T)	-(-)	-(-)	9(5)	-(-)
NEMOPHILA BREVIFLORA	-(-)	-(-)	-(-)	-(-)	-(-)	17(T)	27(4)	-(-)	-(-)	6(13)	-(-)
POLYGONUM DOUGLASII	7(T)	7(T)	-(-)	-(-)	6(T)	6(T)	13(10)	8(T)	-(-)	6(3)	-(-)

(con.)

APPENDIX F (Con.)

	POTR-ABCO/POPR	POTR-PIPU	POTR-PIFL	POTR-PIPO	ALL STANDS
Number of Stands:	12	15	9	18	2137
TREES					
ABIES CONCOLOR	100(26)	33(12)	22(5)	11(1)	8(12)
ABIES LASIOCARPA	-(-)	-(-)	-(-)	-(-)	29(10)
PICEA ENGELMANNII	17(3)	-(-)	33(4)	-(-)	10(6)
PICEA PUNGENS	-(-)	100(22)	-(-)	17(1)	3(7)
PINUS CONTORTA	-(-)	-(-)	-(-)	-(-)	12(9)
PINUS FLEXILIS	8(T)	27(3)	100(18)	6(T)	10(2)
PINUS PONDEROSA	-(-)	7(10)	-(-)	100(27)	3(9)
POPULUS TREMULOIDES	100(66)	100(60)	100(66)	100(56)	100(69)
POPULUS TREMULOIDES (reprod.)	92(4)	93(3)	89(3)	83(5)	78(5)
PSEUDOTSUGA MENZIESII	42(4)	40(4)	22(10)	22(2)	19(5)
SHRUBS					
ACER GLABRUM	-(-)	-(-)	-(-)	-(-)	1(2)
ACER GRANDIDENTATUM	-(-)	-(-)	-(-)	-(-)	7(10)
AMELANCHIER ALNIFOLIA	-(-)	20(T)	-(-)	33(1)	34(7)
ARCTOSTAPHYLOS PATULA	-(-)	-(-)	11(50)	11(3)	1(17)
ARCTOSTAPHYLOS UVA-URSI	-(-)	-(-)	-(-)	11(15)	3(7)
ARTEMISIA TRIDENTATA	-(-)	13(4)	-(-)	11(3)	10(4)
BERBERIS REPENS	33(2)	33(14)	78(6)	61(2)	37(6)
CEANOTHUS VELUTINUS	-(-)	-(-)	-(-)	-(-)	2(6)
CERCOCARPUS LEDIFOLIUS	-(-)	7(2)	11(T)	-(-)	1(2)
CHRYSOTHAMNUS VISCIDIFLORUS	-(-)	27(3)	-(-)	-(-)	3(2)
JUNIPERUS COMMUNIS	25(3)	87(13)	56(9)	72(5)	16(19)
LONICERA INVOLUCRATA	-(-)	-(-)	-(-)	-(-)	1(1)
PACHISTIMA MYRSINITES	-(-)	-(-)	-(-)	6(10)	14(10)
PHYSOCARPUS MALVACEUS	-(-)	-(-)	-(-)	-(-)	2(15)
PRUNUS VIRGINIANA	8(1)	-(-)	11(T)	6(T)	22(13)
QUERCUS GAMBELII	-(-)	-(-)	-(-)	17(33)	2(7)
RIBES CEREUM	8(1)	-(-)	-(-)	6(T)	6(2)
RIBES INERME	-(-)	7(5)	-(-)	-(-)	2(2)
RIBES LACUSTRE	-(-)	-(-)	-(-)	-(-)	1(7)
RIBES MONTIGENUM	-(-)	-(-)	-(-)	6(T)	3(4)
RIBES VISCOSISSIMUM	-(-)	-(-)	-(-)	6(5)	1(1)
ROSA WOODSII +	17(1)	20(T)	22(T)	39(2)	40(3)
RUBUS PARVIFLORUS	-(-)	-(-)	-(-)	-(-)	2(-)
SALIX SCOULERIANA	8(10)	-(-)	-(-)	-(-)	4(5)
SAMBUCUS RACEMOSA +	8(1)	-(-)	11(1)	-(-)	9(3)
SHEPHERDIA CANADENSIS	-(-)	-(-)	-(-)	-(-)	7(6)
SORBUS SCOPULINA	-(-)	-(-)	-(-)	-(-)	3(3)
SPIRAEA BETULIFOLIA	-(-)	-(-)	-(-)	-(-)	2(22)
SYMPHORICARPOS ALBUS	-(-)	-(-)	-(-)	-(-)	5(17)
SYMPHORICARPOS OREOPHILUS	92(3)	60(5)	89(2)	61(15)	73(15)
VACCINIUM CAESPITOSUM	-(-)	-(-)	-(-)	-(-)	+(15)
GRAMINOIDS					
AGROPYRON SPICATUM	-(-)	-(-)	-(-)	-(-)	1(1)
AGROPYRON TRACHYCAULUM +	83(4)	47(2)	67(6)	28(2)	51(4)
BROMUS ANOMALUS	8(10)	53(4)	44(6)	17(5)	7(7)
BROMUS CARINATUS +	67(12)	13(T)	22(T)	11(T)	46(8)
BROMUS CILIATUS	17(3)	-(-)	22(21)	6(1)	11(3)
CALAMAGROSTIS RUBESCENS	-(-)	-(-)	-(-)	-(-)	15(33)
CAREX GEYERI	-(-)	20(11)	-(-)	11(59)	15(16)
CAREX HOODII	8(3)	-(-)	-(-)	-(-)	16(3)
CAREX ROSSII	17(3)	13(7)	78(8)	39(2)	15(4)
DACTYLIS GLOMERATA	-(-)	-(-)	-(-)	6(25)	5(4)
ELYMUS CINEREUS	17(T)	-(-)	-(-)	-(-)	3(4)
ELYMUS GLAUCUS	17(5)	-(-)	11(3)	-(-)	37(10)
FESTUCA IDAHOENSIS +	8(T)	-(-)	11(T)	11(1)	8(2)
FESTUCA THURBERI	-(-)	-(-)	-(-)	-(-)	2(9)
HORDEUM JUBATUM	-(-)	-(-)	-(-)	-(-)	+(T)
KOELERIA CRISTATA	-(-)	13(T)	-(-)	17(1)	2(2)
LEUCOPOA KINGII	-(-)	-(-)	11(T)	-(-)	2(3)
MELICA SPECTABILIS	8(1)	7(T)	11(10)	-(-)	17(2)
PHLEUM ALPINUM	-(-)	-(-)	11(T)	-(-)	4(5)
PHLEUM PRATENSE	-(-)	-(-)	-(-)	-(-)	4(2)
POA AMPLA	-(-)	-(-)	11(T)	-(-)	3(2)
POA FENDLERIANA	-(-)	13(3)	56(7)	50(3)	6(3)
POA NERVOSA	25(23)	-(-)	44(1)	6(T)	17(4)
POA PALUSTRIS	-(-)	-(-)	11(3)	-(-)	2(6)
POA PRATENSIS	100(22)	47(11)	-(-)	44(5)	34(15)
SITANION HYSTRIX	8(T)	27(2)	22(1)	44(5)	6(2)
STIPA COMATA	-(-)	13(15)	-(-)	22(10)	2(9)
STIPA OCCIDENTALIS +	42(4)	67(6)	11(T)	17(T)	25(6)
TRISETUM SPICATUM	8(T)	-(-)	22(1)	6(T)	8(1)

(con.)

APPENDIX F (Con.)

	POTR-ABCO/POPR	POTR-PIPU	POTR-PIFL	POTR-PIPO	ALL STANDS
Number of Stands:	12	15	9	18	2137
FORBS					
ACHILLEA MILLEFOLIUM	75(2)	80(1)	89(1)	50(2)	56(2)
ACONITUM COLUMBIANUM	-(-)	-(-)	-(-)	-(-)	1(5)
ACTAEA RUBRA	8(T)	-(-)	-(-)	-(-)	3(4)
AGASTACHE URTICIFOLIA	-(-)	-(-)	-(-)	-(-)	27(4)
AGOSERIS AURANTIACA	-(-)	-(-)	11(T)	-(-)	2(T)
AGOSERIS GLAUCA	-(-)	-(-)	22(T)	11(T)	7(T)
ALLIUM BREVISTYLUM	-(-)	-(-)	-(-)	6(T)	2(1)
ANGELICA PINNATA	-(-)	-(-)	-(-)	-(-)	1(1)
ANTENNARIA MICROPHYLLA	-(-)	27(6)	-(-)	28(T)	9(2)
APOCYNUM ANDROSAEMIFOLIUM	-(-)	-(-)	-(-)	-(-)	2(2)
AQUILEGIA COERULEA	-(-)	7(T)	-(-)	6(3)	10(1)
AQUILEGIA FORMOSA	8(2)	-(-)	-(-)	-(-)	5(4)
ARNICA CORDIFOLIA	-(-)	-(-)	33(7)	-(-)	12(8)
ARNICA LATIFOLIA	-(-)	-(-)	-(-)	-(-)	2(9)
ARTEMISIA LUDOVICIANA	-(-)	-(-)	-(-)	-(-)	2(3)
ASTER CHILENSIS	-(-)	7(T)	-(-)	-(-)	2(1)
ASTER ENGELMANNII	-(-)	-(-)	-(-)	-(-)	18(3)
ASTER FOLIACEUS	-(-)	-(-)	-(-)	-(-)	6(3)
ASTER PERELEGANS	8(T)	-(-)	-(-)	-(-)	3(1)
ASTRAGALUS MISER	8(10)	40(2)	22(8)	17(4)	13(10)
BALSAMORHIZA MACROPHYLLA	-(-)	-(-)	-(-)	-(-)	2(6)
BALSAMORHIZA SAGITTATA	-(-)	-(-)	11(T)	-(-)	2(4)
CALOCHORTUS NUTTALLII	-(-)	13(T)	-(-)	6(T)	2(T)
CAMPANULA ROTUNDIFOLIA	-(-)	7(T)	-(-)	6(T)	4(T)
CASTILLEJA LINARIAEFOLIA	-(-)	-(-)	-(-)	-(-)	3(1)
CASTILLEJA MINIATA	8(T)	20(T)	22(T)	-(-)	11(1)
CIRSIUM ARVENSE	-(-)	20(2)	11(T)	-(-)	3(1)
CIRSIUM VULGARE	-(-)	-(-)	-(-)	-(-)	1(1)
CLAYTONIA LANCEOLATA	-(-)	-(-)	-(-)	-(-)	1(4)
CORALLORHIZA MACULATA	8(T)	-(-)	-(-)	6(T)	6(T)
CREPIS ACUMINATA	8(T)	7(T)	-(-)	-(-)	2(T)
DELPHINIUM NUTTALLIANUM	-(-)	-(-)	-(-)	11(T)	7(T)
DELPHINIUM OCCIDENTALE +	17(T)	-(-)	11(T)	-(-)	12(3)
DISPORUM TRACHYCARPUM	-(-)	-(-0	-(-)	-(-)	2(T)
EPILOBIUM ANGUSTIFOLIUM	-(-)	7(T)	11(T)	-(-)	12(3)
EQUISETUM ARVENSE	-(-)	-(-)	-(-)	-(-)	+(17)
ERIGERON FLAGELLARIS	-(-)	13(T)	11(1)	-(-)	1(T)
ERIGERON PEREGRINUS	-(-)	-(-)	-(-)	-(-)	2(2)
ERIGERON SPECIOSUS	-(-)	-(-)	-(-)	22(1)	13(2)
FRAGARIA VESCA +	-(-)	47(4)	22(1)	39(1)	24(3)
FRASERA SPECIOSA	-(-)	-(-)	-(-)	11(T)	14(1)
FRITILLARIA ATROPURPUREA	-(-)	-(-)	-(-)	-(-)	1(T)
GALIUM BOREALE	-(-)	13(3)	-(-)	6(T)	17(2)
GERANIUM RICHARDSONII	8(T)	7(3)	-(-)	-(-)	5(6)
GERANIUM VISCOSISSIMUM +	8(2)	20(T)	11(10)	28(1)	45(7)
HABENARIA UNALASCENSIS	-(-)	-(-)	-(-)	-(-)	5(T)
HACKELIA FLORIBUNDA	-(-)	-(-)	11(2)	-(-)	25(3)
HACKELIA PATENS	8(4)	-(-)	-(-)	-(-)	1(1)
HEDYSARUM BOREALE	-(-)	-(-)	-(-)	-(-)	4(2)
HELENIUM HOOPESII	-(-)	13(T)	-(-)	-(-)	4(2)
HELIANTHELLA UNIFLORA	-(-)	-(-)	-(-)	-(-)	5(3)
HERACLEUM LANATUM	-(-)	-(-)	-(-)	-(-)	4(9)
HIERACIUM ALBIFLORUM	-(-)	-(-)	-(-)	-(-)	2(1)
HIERACIUM CYNOGLOSSOIDES	-(-)	7(T)	-(-)	-(-)	4(T)
HYDROPHYLLUM CAPITATUM	-(-)	-(-)	11(T)	-(-)	12(1)
LATHYRUS LANSZWERTII	-(-)	13(25)	-(-)	6(5)	16(16)
LATHYRUS LEUCANTHUS	-(-)	7(T)	-(-)	17(13)	9(19)
LATHYRUS PAUCIFLORUS	-(-)	-(-)	-(-)	-(-)	4(3)
LIGUSTICUM FILICINUM	-(-)	-(-)	11(20)	-(-)	6(10)
LUPINUS ARGENTEUS	-(-)	7(10)	11(3)	22(5)	30(7)
LUPINUS CAUDATUS	-(-)	-(-)	-(-)	-(-)	2(2)
LUPINUS LAXIFLORUS	25(2)	-(-)	-(-)	-(-)	4(4)
LUPINUS SERICEUS	-(-)	-(-)	-(-)	-(-)	3(5)
MERTENSIA ARIZONICA +	8(5)	13(13)	22(T)	-(-)	13(8)
MERTENSIAL LONGIFLORA	-(-)	-(-)	-(-)	-(-)	1(6)
OSMORHIZA CHILENSIS +	25(4)	47(T)	11(2)	6(T)	44(5)
OSMORHIZA OCCIDENTALIS	25(4)	7(T)	11(2)	-(-)	19(7)
PAEONIA BROWNII	-(-)	-(-)	-(-)	-(-)	1(1)
PENSTEMON PROCERUS	-(-)	-(-)	-(-)	6(T)	1(1)
PENSTEMON WATSONI	8(T)	-(-)	67(1)	-(-)	5(1)

(con.)

APPENDIX F (Con.)

	POTR-ABCO/POPR	POTR-PIPU	POTR-PIFL	POTR-PIPO	ALL STANDS
Number of Stands:	12	15	9	18	2137
PERIDERIDIA GAIRDNERI	-(-)	-(-)	-(-)	-(-)	10(1)
PHACELIA HETEROPHYLLA	-(-)	-(-)	33(T)	-(-)	7(1)
POLEMONIUM FOLIOSISSIMUM +	-(-)	-(-)	-(-)	-(-)	9(2)
POTENTILLA DIVERSIFOLIA	-(-)	33(T)	-(-)	11(T)	1(1)
POTENTILLA GLANDULOSA	-(-)	-(-)	-(-)	-(-)	17(1)
POTENTILLA GRACILIS	8(T)	-(-)	11(1)	11(2)	14(1)
PTERIDIUM AQUILINUM	-(-)	-(-)	-(-)	-(-)	1(44)
RANUNCULUS INAMOENUS	-(-)	-(-)	-(-)	-(-)	2(1)
RUDBECKIA OCCIDENTALIS	-(-)	-(-)	-(-)	-(-)	23(10)
SCROPHULARIA LANCEOLATA	-(-)	-(-)	-(-)	-(-)	5(1)
SENECIO CRASSULUS	-(-)	-(-)	11(T)	6(T)	3(2)
SENECIO CYMBALARIOIDES	-(-)	-(-)	-(-)	6(T)	7(1)
SENECIO INTEGERRIMUS	-(-)	-(-)	-(-)	-(-)	4(1)
SENECIO SERRA +	-(-)	-(-)	11(1)	-(-)	24(4)
SENECIO STREPTANTHIFOLIUS	-(-)	-(-)	-(-)	-(-)	2(T)
SIDALCEA OREGANA	-(-)	-(-)	-(-)	-(-)	2(1)
SILENE MENZIESII	-(-)	-(-)	-(-)	-(-)	7(1)
SMILACINA RACEMOSA	-(-)	-(-)	-(-)	-(-)	8(2)
SMILACINA STELLATA	-(-)	7(T)	-(-)	6(T)	18(3)
STELLARIA JAMESIANA	50(3)	7(T)	67(4)	11(T)	35(2)
TARAXACUM OFFICINALE	92(6)	80(6)	33(T)	61(2)	49(3)
THALICTRUM FENDLERI +	42(5)	27(5)	44(9)	22(T)	54(10)
THERMOPSIS MONTANA	8(T)	-(-)	-(-)	17(6)	2(7)
TRAGOPOGON DUBIUS	-(-)	-(-)	-(-)	-(-)	4(T)
TRIFOLIUM GYMNOCARPON	17(8)	-(-)	67(9)	-(-)	2(7)
TRIFOLIUM LONGIPES	-(-)	-(-)	-(-)	11(2)	5(11)
URTICA DIOICA	-(-)	-(-)	-(-)	-(-)	2(1)
VALERIANA OCCIDENTALIS	-(-)	-(-)	-(-)	-(-)	25(5)
VERATRUM CALIFORNICUM	-(-)	-(-)	-(-)	-(-)	1(17)
VERBASCUM THAPSUS	-(-)	-(-)	-(-)	-(-)	1(T)
VICIA AMERICANA	50(3)	27(16)	-(-)	17(1)	16(6)
VIGUIERA MULTIFLORA	-(-)	-(-)	-(-)	-(-)	3(2)
VIOLA ADUNCA	-(-)	-(-)	-(-)	-(-)	10(1)
VIOLA NUTTALLII	33(4)	-(-)	-(-)	-(-)	13(2)
VIOLA PURPUREA	-(-)	-(-)	-(-)	-(-)	2(1)
WYETHIA AMPLEXICAULIS	-(-)	-(-)	-(-)	-(-)	4(15)
ANNUALS					
ANDROSACE SEPTENTRIONALIS	-(-)	-(-)	-(-)	-(-)	3(1)
CHENOPODIUM FREMONTII	8(T)	-(-)	-(-)	-(-)	4(1)
COLLINSIA PARVIFLORA	-(-)	-(-)	11(1)	6(T)	8(5)
COLLOMIA LINEARIS	-(-)	-(-)	-(-)	-(-)	11(2)
DESCURAINIA RICHARDSONII	25(T)	13(T)	11(T)	6(T)	20(1)
GALIUM APARINE	-(-)	-(-)	-(-)	-(-)	2(7)
GALIUM BIFOLIUM	-(-)	-(-)	-(-)	-(-)	15(5)
MADIA GLOMERATA	-(-)	-(-)	-(-)	-(-)	+(2)
NEMOPHILA BREVIFLORA	8(15)	-(-)	-(-)	-(-)	18(17)
POLYGONUM DOUGLASII	8(T)	-(-)	-(-)	-(-)	13(4)

APPENDIX G: PRODUCTIVITY RANGE OF DIFFERENT VEGETATION ELEMENTS IN ASPEN COMMUNITIES OF THE INTERMOUNTAIN REGION

	Percentile						Maximum value
Vegetation element	10	25	33.3	66.6	75	90	
	Upper production limit of percentile group						
Total stand basal area (ft^2/acre)	88	113	122	168	183	230	351
Aspen basal area (ft^2/acre)	79	102	112	155	168	206	342
Aspen site index (ft height at 80 years)	36	41	44	54	56	63	78
Aspen volume growth (ft^3/acre/year)	21	28	32	44	47	56	76
Aspen reproduction,<3 dm tall (number/acre)	26	90	142	593	928	2,650	24,940
Aspen reproduction, 3-14 dm tall (number/acre)	13	116	193	825	1,213	2,598	12,876
Aspen tree density (number/acre)	335	451	541	850	992	1,559	6,985
Total undergrowth production (lb a.d./acre)	324	571	679	1,081	1,224	1,691	3,796
Total shrub production (lb a.d./acre)	5	11	15	128	200	429	1,644
Total forb production (lb a.d./acre)	73	191	263	568	678	1,088	3,569
Total graminoid production (lb a.d./acre)	9	49	87	321	404	698	2,587
Total production of annuals (lb a.d./acre)	0	5	7	17	24	56	487
Desirable forage (percent)	28	40	44	54	57	62	85
Intermediate forage (percent)	26	34	38	45	46	51	75
Least desirable forage (percent)	1	3	4	9	13	27	51

APPENDIX H: MEANS, STANDARD ERRORS, AND RANGES OF TOTAL STAND BASAL AREA, AND THE PERCENTAGE OF THIS BASAL AREA CONSISTING OF CONIFERS, BY COMMUNITY TYPES IN THE INTERMOUNTAIN REGION

Community type	Stands in data base	Total stand basal area		Percent conifers
		m^2/ha	$Ft^2/acre$	
Major community types				
POTR/TALL FORB	64			
mean		35.6	155	2
SE		1.5	7	
range		15.3-69.4	67-302	
POTR/SYOR/TALL FORB	41			
mean		29.8	130	1
SE		1.8	8	
range		5.1-53.4	22-233	
POTR/AMAL-SYOR/ TALL FORB	28			
mean		26.5	116	1
SE		1.2	5	
range		10.4-38.2	45-166	
POTR-ABLA/TALL FORB	17			
mean		38.9	169	28
SE		3.5	15	
range		20.4-64.9	89-283	
POTR/CARU	26			
mean		36.7	160	1
SE		2.5	11	
range		13.9-73.9	61-322	
POTR/SYOR/CARU	20			
mean		35.6	155	1
SE		2.8	12	
range		17.6-67.0	76-292	
POTR/AMAL-SYOR/CARU	32			
mean		26.9	117	1
SE		1.3	6	
range		8.2-42.8	36-186	
POTR/THFE	24			
mean		38.7	169	11
SE		2.7	12	
range		13.5-64.5	59-281	
POTR/SYOR/THFE	12			
mean		29.2	127	4
SE		2.3	10	
range		16.9-41.9	74-183	
POTR/AMAL-SYOR/THFE	6			
mean		30.9	134	2
SE		3.4	15	
range		21.9-46.4	95-202	
POTR/CARO	11			
mean		43.8	191	3
SE		3.3	14	
range		22.5-62.6	98-273	
POTR-ABLA/CARO	16			
mean		43.7	190	24
SE		3.3	14	
range		25.1-71.9	109-313	
POTR/BRCA	32			
mean		34.1	149	2
SE		2.4	11	
range		9.0-60.5	39-264	
POTR/SYOR/BRCA	10			
mean		23.8	104	2
SE		1.0	4	
range		16.1-28.3	70-123	
Minor community types				
POTR/WYAM	2			
mean		17.0	74	0
SE		8.8	38	
range		8.3-25.8	36-112	
POTR/ARTR	3			
mean		12.8	56	8
SE		1.2	5	
range		10.9-15.0	47-65	
POTR/JUCO/CAGE	3			
mean		37.2	162	T[1]
SE		8.3	36	
range		20.8-47.5	90-207	
POTR/POPR	8			
mean		43.7	190	2
SE		5.5	24	
range		26.6-64.3	116-280	
POTR/SYOR/POPR	11			
mean		24.4	106	1
SE		3.6	16	
range		3.3-44.5	14-194	
POTR/AMAL/THFE	4			
mean		29.6	129	2
SE		2.7	12	
range		21.5-33.6	94-146	
POTR/AMAL/TALL FORB	9			
mean		28.4	124	T
SE		3.7	16	
range		12.6-44.3	55-193	
POTR/AMAL-SYOR/BRCA	5			
mean		23.7	103	T
SE		2.2	9	
range		17.8-30.7	78-134	
POTR-ABLA/SYOR/TALL FORB	4			
mean		34.1	149	12
SE		1.5	13	
range		29.6-35.9	129-156	
POTR-ABLA/THFE	16			
mean		47.0	205	29
SE		3.6	16	
range		25.0-74.1	109-323	
POTR-ABCO/SYOR	4			
mean		45.6	199	38
SE		2.0	9	
range		40.7-49.3	177-215	
Incidental community types				
POTR/VECA	1			
mean		16.4	71	0
SE		—	—	
range		—	—	

(con.)

APPENDIX H (Con.)

Community type	Stands in data base	Total stand basal area		Percent conifers
		m^2/ha	Ft^2/acre	
POTR/RUPA	1			
mean		17.0	74	13
SE		—	—	
range		—	—	
POTR/SARA	6			
mean		31.3	137	1
SE		4.9	22	
range		16.1-47.1	70-205	
POTR/PTAQ	5			
mean		33.6	146	1
SE		5.5	24	
range		17.3-51.4	76-224	
POTR/AMAL/PTAQ	5			
mean		31.2	136	T
SE		2.4	11	
range		25.8-40.0	113-174	
POTR/FETH	6			
mean		51.4	224	1
SE		8.6	37	
range		30.8-80.6	134-351	
POTR/SYOR/FETH	1			
mean		40.9	178	1
SE		—	—	
range		—	—	
POTR/SYOR/CARO	3			
mean		35.8	156	5
SE		2.8	12	
range		33.0-41.4	144-180	
POTR/ASMI	3			
mean		34.0	148	1
SE		26.4	29	
range		26.4-47.4	115-206	
POTR/JUCO/ASMI	3			
mean		35.0	152	12
SE		4.8	21	
range		29.7-44.6	129-194	
POTR/JUCO/LUAR	1			
mean		44.3	193	T
SE		—	—	
range		—	—	
POTR/STCO	6			
mean		34.8	152	4
SE		4.0	17	
range		21.5-46.6	94-203	
POTR/SHCA	1			
mean		31.2	136	0
SE		—	—	
range		—	—	
POTR-ABLA/SHCA	1			
mean		39.1	170	21
SE		—	—	
range		—	—	
POTR-ABLA/AMAL	5			
mean		33.5	146	13
SE		9.3	40	
range		12.1-66.2	53-288	
POTR-ABLA/SYOR/BRCA	1			
mean		24.3	106	8
SE		—	—	
range		—	—	
POTR-ABLA/SYOR/THFE	4			
mean		44.2	192	20
SE		9.8	43	
range		15.5-57.3	67-249	
POTR-ABLA/JUCO	1			
mean		37.1	161	23
SE		—	—	
range		—	—	
POTR-ABLA/CAGE	5			
mean		38.9	169	14
SE		6.2	27	
range		21.3-58.1	93-253	
POTR-PICO/SYOR	2			
mean		29.0	126	12
SE		2.5	11	
range		26.5-31-5	115-137	
POTR-PICO/THFE	1			
mean		36.9	161	35
SE		—	—	
range		—	—	
POTR-PICO/CAGE	5			
mean		31.8	139	15
SE		3.9	17	
range		23.8-45.4	104-198	
POTR-PSME/AMAL	5			
mean		39.0	170	11
SE		7.1	31	
range		24.2-64.9	105-283	
POTR-PSME/SYOR	6			
mean		31.5	137	14
SE		2.8	12	
range		24.2-43.5	106-190	
POTR-PSME/JUCO	1			
mean		44.2	192	12
SE		—	—	
range		—	—	
POTR-PSME/CARU	1			
mean		38.8	169	9
SE		—	—	
range		—	—	
POTR-PIPO	3			
mean		36.8	160	28
SE		5.1	22	
range		27.0-44.3	118-193	
All stands	491			
mean		34.1	148	7
SE		0.6	3	
range		3.3-80.6	14-351	

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[1] T = less than 0.5 percent.

APPENDIX I: ASPEN PRODUCTIVITY BY COMMUNITY TYPES WITHIN THE INTERMOUNTAIN REGION; MEANS, STANDARD ERRORS, AND RANGES OF BASAL AREA, SITE INDEX, AND ESTIMATED MEAN ANNUAL TOTAL VOLUME INCREMENT FOR *POPULUS TREMULOIDES*

Community type	Stands in data base	Basal area		Site index[1] at 80 years		Total volume[2] increment/year	
		m^2/ha	*Ft^2/acre*	*m*	*Ft*	*m^3/ha*	*Ft^3/acre*
Major community types							
POTR/TALL FORB	64						
mean		34.8	152	15.7	52	2.9	41
SE		1.6	7	0.4	1	0.1	2
range		15.3-69.4	67-302	9.9-23.2	32-76	1.1-5.2	16-74
POTR/SYOR/TALL FORB	41						
mean		29.7	129	14.3	47	2.4	35
SE		1.8	8	0.6	2	0.2	2
range		5.1-53.4	22-233	7.8-23.7	26-78	0.5-5.3	7-76
POTR/AMAL-SYOR/ TALL FORB	28						
mean		26.4	115	14.1	46	2.4	34
SE		1.2	5	0.5	2	0.2	2
range		10.4-38.2	45-166	9.4-18.3	31-60	1.0-3.7	14-53
POTR-ABLA/TALL FORB	17						
mean		28.0	122	16.6	55	3.2	45
SE		2.1	9	0.7	2	0.2	3
range		16.3-45.5	71-198	10.1-20.1	33-66	1.2-4.2	17-60
POTR/CARU	26						
mean		36.5	159	15.5	51	2.8	40
SE		2.5	11	0.6	2	0.2	3
range		13.9-73.9	61-322	9.5-21.5	31-71	1.0-4.6	15-66
POTR/SYOR/CARU	20						
mean		35.3	154	16.1	53	3.0	43
SE		2.8	12	0.7	2	0.2	3
range		16.8-67.0	73-292	11.2-23.2	37-76	1.5-5.1	22-73
POTR/AMAL-SYOR/CARU	32						
mean		26.6	116	14.9	49	2.6	38
SE		1.3	6	0.5	2	0.1	2
range		8.2-42.8	36-186	10.1-20.6	33-67	1.2-4.4	17-62
POTR/THFE	24						
mean		34.6	151	14.4	47	2.5	36
SE		2.4	10	0.7	2	0.2	3
range		13.5-64.3	59-280	9.7-23.0	32-75	1.1-5.1	15-73
POTR/SYOR/THFE	12						
mean		28.0	122	14.6	48	2.5	36
SE		2.2	10	0.9	3	0.3	4
range		16.9-41.9	74-183	10.7-19.7	35-65	1.4-4.1	20-58
POTR/AMAL-SYOR/THFE	6						
mean		3.03	132	13.0	43	2.1	30
SE		3.7	16	1.1	4	0.3	5
range		18.7-46.4	81-202	10.7-17.1	35-56	1.4-3.3	19-47
POTR/CARO	11						
mean		42.4	185	15.2	50	2.7	39
SE		3.2	14	0.7	2	0.2	3
range		21.7-62.6	94-273	9.9-19.3	32-63	1.1-4.0	16-57
POTR-ABLA/CARO	16						
mean		33.3	145	13.3	44	2.1	31
SE		3.1	13	0.5	2	0.2	2
range		14.0-54.6	61-238	9.2-16.3	30-54	0.9-3.1	13-44

(con.)

APPENDIX I (Con.)

Community type	Stands in data base	Basal area		Site index[1] at 80 years		Total volume[2] increment/year	
		m²/ha	*Ft²/acre*	*m*	*Ft*	*m³/ha*	*Ft³/acre*
POTR/BRCA	32						
mean		33.3	145	16.3	54	3.1	44
SE		2.3	10	0.5	2	0.1	2
range		9.0-56.9	39-248	12.0-23.4	39-77	1.8-5.2	25-74
POTR/SYOR/BRCA	10						
mean		23.2	101	14.5	47	2.5	36
SE		1.0	5	0.5	2	0.2	2
range		16.0-28.3	70-123	11.2-16.8	37-55	1.5-3.2	22-46
Minor community types							
POTR/WYAM	2						
mean		17.0	74	9.1	30	0.9	13
SE		8.8	38	1.0	3	0.3	4
range		8.2-25.8	36-112	8.1-10.0	27-33	0.6-1.2	8-17
POTR/ARTR	3						
mean		11.7	51	8.9	29	0.8	12
SE		1.6	7	1.3	4	0.4	6
range		9.8-15.0	43-65	7.2-11.5	24-38	0.3-1.6	4-23
POTR/JUCO/CAGE	3						
mean		37.2	162	14.5	48	2.5	36
SE		8.3	36	1.8	6	0.5	8
range		20.8-47.5	90-207	11.2-17.3	37-57	1.5-3.4	22-48
POTR/POPR	8						
mean		42.9	187	16.4	54	3.1	44
SE		5.5	24	1.1	4	0.3	5
range		25.3-64.3	110-280	10.7-20.8	35-68	1.4-4.4	20-63
POTR/SYOR/POPR	11						
mean		24.1	105	15.3	50	2.8	40
SE		3.4	16	0.8	3	0.2	3
range		3.3-44.5	14-194	11.9-20.5	39-67	1.7-4.3	25-62
POTR/AMAL/THFE	4						
mean		29.1	127	13.8	45	2.3	33
SE		2.7	12	2.0	7	0.6	9
range		21.5-33.6	94-146	10.2-19.4	34-64	1.2-4.0	17-57
POTR/AMAL/TALL FORB	9						
mean		28.3	123	14.5	47	2.5	36
SE		3.7	16	1.1	4	0.3	5
range		12.6-44.3	55-193	9.3-20.2	31-66	1.0-4.2	14-61
POTR/AMAL-SYOR/BRCA	5						
mean		23.7	103	14.8	49	2.6	37
SE		2.2	9	0.9	3	0.3	4
range		17.9-30.7	78-134	12.4-17.3	41-57	1.9-3.4	27-48
POTR-ABLA/SYOR/ TALL FORB	4						
mean		30.0	131	15.4	51	2.9	40
SE		1.2	5	1.7	6	0.5	7
range		27.3-32.4	119-141	11.5-18.6	38-61	1.6-3.7	23-54
POTR-ABLA/THFE	16						
mean		33.2	145	15.0	49	2.7	38
SE		3.3	15	0.8	2	0.2	3
range		10.8-65.0	47-283	10.1-20.7	33-68	1.2-4.4	17-63
POTR-ABCO/SYOR	4						
mean		28.1	122	11.2	37	1.5	22
SE		2.2	10	0.6	2	0.2	3
range		25.1-34.7	110-151	9.7-12.3	32-40	1.1-1.9	15-26

(con.)

APPENDIX I (Con.)

Community type	Stands in data base	Basal area		Site index[1] at 80 years		Total volume[2] increment/year	
		m²/ha	*Ft²/acre*	*m*	*Ft*	*m³/ha*	*Ft³/acre*
Incidental community types							
POTR/VECA	1						
mean		16.4	71	20.4	67	4.3	61
SE		—	—	—	—	—	—
range		—	—	—	—	—	—
POTR/RUPA	1						
mean		14.8	64	19.9	65	4.2	60
SE		—	—	—	—	—	—
range		—	—	—	—	—	—
POTR/SARA	6						
mean		31.0	135	15.2	50	2.7	39
SE		5.0	22	1.3	4	0.4	6
range		16.1-47.0	70-205	11.0-18.2	36-60	1.5-3.6	21-52
POTR/PTAQ	5						
mean		33.4	145	17.5	57	3.4	49
SE		5.6	24	1.6	5	0.5	7
range		16.6-51.4	72-224	13.9-22.3	46-73	2.3-4.9	33-70
POTR/AMAL/PTAQ	5						
mean		31.2	136	17.3	57	3.4	48
SE		2.4	10	1.5	5	0.4	6
range		25.8-40.0	113-174	12.7-21.6	42-71	2.0-4.7	28-67
POTR/FETH	6						
mean		51.0	222	17.0	56	3.3	47
SE		8.3	36	0.7	2	0.2	3
range		30.7-78.4	134-342	14.5-19.8	48-65	2.5-4.1	36-59
POTR/SYOR/FETH	1						
mean		40.6	177	15.0	49	2.7	38
SE		—	—	—	—	—	—
range		—	—	—	—	—	—
POTR/SYOR/CARO	3						
mean		34.0	148	14.0	46	2.4	34
SE		2.3	10	0.7	2	0.2	3
range		30.6-38.5	133-168	13.1-15.3	43-50	2.1-2.8	30-39
POTR/ASMI	3						
mean		33.8	147	11.8	39	1.7	24
SE		6.8	30	0.8	3	0.2	3
range		25.8-47.4	112-206	10.2-12.7	34-42	1.2-2.0	18-28
POTR/JUCO/ASMI	3						
mean		30.8	134	12.1	40	1.8	25
SE		3.1	14	1.1	3	0.3	5
range		25.5-36.4	111-158	10.0-13.6	33-45	1.2-2.2	17-32
POTR/JUCO/LUAR	1						
mean		44.3	193	13.5	44	2.2	32
SE		—	—	—	—	—	—
range		—	—	—	—	—	—
POTR/STCO	6						
mean		33.4	146	13.1	43	2.1	30
SE		3.9	17	1.2	4	0.4	5
range		21.3-45.5	93-198	9.0-17.7	30-58	0.9-3.5	12-50
POTR/SHCA	1						
mean		31.2	136	14.9	49	2.6	38
SE		—	—	—	—	—	—
range		—	—	—	—	—	—

(con.)

APPENDIX I (Con.)

Community type	Stands in data base	Basal area		Site index[1] at 80 years		Total volume[2] increment/year	
		m^2/ha	Ft^2/acre	m	Ft	m^3/ha	Ft^3/acre
POTR-ABLA/SHCA	1						
mean		30.9	135	13.2	43	2.1	30
SE		—	—	—	—	—	—
range		—	—	—	—	—	—
POTR-ABLA/AMAL	5						
mean		29.1	127	16.2	53	3.0	43
SE		8.3	36	0.8	3	0.2	4
range		9.9-58.6	43-255	14.7-19.2	48-63	2.6-4.0	37-56
POTR-ABLA/SYOR/BRCA	1						
mean		22.2	97	13.7	45	2.3	33
SE		—	—	—	—	—	—
range		—	—	—	—	—	—
POTR-ABLA/SYOR/THFE	4						
mean		35.5	155	14.5	48	2.5	36
SE		9.1	39	2.4	8	0.7	11
range		9.0-48.9	39-213	8.7-20.1	29-66	0.8-4.2	11-60
POTR-ABLA/JUCO	1						
mean		28.5	124	17.1	56	3.3	47
SE		—	—	—	—	—	—
range		—	—	—	—	—	—
POTR-ABLA/CAGE	5						
mean		33.4	146	14.0	46	2.4	34
SE		5.3	23	2.3	8	0.7	10
range		15.1-46.8	66-204	7.2-18.1	24-59	0.3-3.6	4-52
POTR-PICO/SYOR	2						
mean		25.6	111	11.7	39	1.7	24
SE		3.3	14	0.5	2	0.1	2
range		22.3-28.8	97-126	11.3-12.2	37-40	1.5-1.8	22-26
POTR-PICO/THFE	1						
mean		23.5	103	13.9	46	2.3	33
SE		—	—	—	—	—	—
range		—	—	—	—	—	—
POTR-PICO/CAGE	5						
mean		27.2	119	14.0	46	2.4	34
SE		4.0	17	1.9	6	0.6	8
range		19.4-41.8	84-182	11.6-21.4	38-70	1.6-4.6	24-66
POTR-PSME/AMAL	5						
mean		34.6	151	17.2	56	3.3	48
SE		7.8	34	0.8	2	0.2	3
range		19.6-62.9	85-274	14.5-18.5	48-61	2.5-3.7	36-53
POTR-PSME/SYOR	6						
mean		27.0	118	16.3	54	3.1	44
SE		2.5	11	1.3	4	0.4	6
range		20.9-36.9	91-161	11.0-19.1	36-63	1.5-3.9	21-56
POTR-PSME/JUCO	1						
mean		39.0	170	17.0	56	3.3	47
SE		—	—	—	—	—	—
range		—	—	—	—	—	—
POTR-PSME/CARU	1						
mean		35.4	154	15.7	52	2.9	41
SE		—	—	—	—	—	—
range		—	—	—	—	—	—

(con.)

APPENDIX I (Con.)

Community type	Stands in data base	Basal area		Site index[1] at 80 years		Total volume[2] increment/year	
		m²/ha	*Ft²/acre*	*m*	*Ft*	*m³/ha*	*Ft³/acre*
POTR-PIPO	3						
mean		26.4	115	13.9	46	2.3	33
SE		1.4	6	1.3	4	0.4	6
range		24.5-29.1	107-127	12.3-16.6	40-54	1.8-3.1	26-45
All stands	491						
mean		31.7	138	15.0	49	2.7	38
SE		0.5	2	0.1	1	0.1	1
range		3.3-78.4	14-342	7.2-23.7	24-78	0.3-5.3	4-76

[1] Site index using relationships developed by Edminster and others (1985).
[2] Net volume at culmination of growth, based on site index only, after Mowrer (1986).

APPENDIX J: ASPEN REPRODUCTION IN TWO HEIGHT CLASSES AND DENSITY OF ASPEN TREES BY COMMUNITY TYPE WITHIN THE INTERMOUNTAIN REGION

Community type	Stands in data base	Aspen reproduction		Tree density	Aspen reproduction		Tree density
		<3 dm	3-14 dm		<12 in	12-55 in	
		No./ha			No./acre		
Major community types							
POTR/TALL FORB	64						
mean		2,703	3,852	2,401	1,094	1,559	972
SE		445	645	222	180	261	90
range		0-16,179	0-26,242	316-9,203	0-6,547	0-10,620	128-3,725
POTR/SYOR/TALL FORB	41						
mean		2,383	1,571	2,112	964	636	855
SE		1,511	402	190	612	163	77
range		0-61,625	0-10,573	637-6,018	0-24,938	0-4,279	258-2,436
POTR/AMAL-SYOR/ TALL FORB	28						
mean		4,121	2,154	1,932	1,668	872	782
SE		1,714	652	198	694	264	80
range		0-45,733	0-14,522	351-4,521	0-18,507	0-5,877	142-1,830
POTR-ABLA/TALL FORB	17						
mean		3,121	3,520	1,359	1,263	1,425	550
SE		773	955	170	313	386	69
range		96-9,554	64-14,268	509-2,992	39-3,866	26-5,774	206-1,211
POTR/CARU	26						
mean		2,347	2,860	2,411	950	1,157	976
SE		551	564	373	223	228	151
range		32-11,210	64-11,465	702-10,572	13-4,537	26-4,640	284-4,279
POTR/SYOR/CARU	20						
mean		2,352	2,726	2,920	952	1,103	1,182
SE		1,275	927	808	516	375	327
range		0-25,478	96-18,472	763-17,257	0-10,310	39-7,475	309-6,985
POTR/AMAL-SYOR/CARU	32						
mean		961	1,843	1,947	389	746	788
SE		187	314	245	76	127	99
range		0-4,013	32-7,325	605-7,706	0-1,624	13-2,964	245-3,119
POTR/THFE	24						
mean		1,916	2,322	2,678	775	940	1,084
SE		729	542	398	295	219	161
range		0-17,835	0-9,554	605-8,820	0-7,217	0-3,866	245-3,570
POTR/SYOR/THFE	12						
mean		1,292	1,757	2,871	523	711	1,162
SE		409	530	961	166	214	389
range		191-5,096	0-5,669	1,018-12,546	77-2,062	0-2,294	412-5078
POTR/AMAL-SYOR/THFE	6						
mean		1,640	4,984	2,649	664	2,017	1,072
SE		1,432	4,586	1,161	580	1856	470
range		32-8,790	0-27,898	731-8,215	13-3,557	0-11,290	296-3,325
POTR/CARO	11						
mean		1,630	1,393	2,194	660	564	888
SE		279	652	598	113	264	242
range		605-3,345	0-5,892	731-7,545	245-1,353	0-2,384	296-3,054
POTR-ABLA/CARO	16						
mean		4,337	991	1,806	1,755	401	731
SE		1,347	419	380	545	170	154
range		0-20,988	0-5,828	222-6,051	0-8,493	0-2,358	90-2,449
POTR/BRCA	32						
mean		3,197	3,594	1,939	1,294	1,454	785
SE		872	877	227	353	355	92
range		0-20,382	0-19,109	319-6,018	0-8,248	0-7,733	129-2,436

(con.)

APPENDIX J (Con.)

Community type	Stands in data base	Aspen reproduction		Tree density	Aspen reproduction		Tree density
		<3 dm	3-14 dm		<12 in	12-55 in	
		No./ha			No./acre		
POTR/SYOR/BRCA	10						
mean		7,319	8,621	2,483	2,962	3,489	1,005
SE		3,116	4,015	531	1,261	1,625	215
range		0-25,860	0-31,816	924-6,399	0-10,465	0-12,875	374-2,590
Minor community types							
POTR/WYAM	2						
mean		127	494	1,640	52	200	664
SE		0	462	366	0	187	148
range		127-127	32-955	1,275-2,006	52-52	13-387	516-812
POTR/ARTR	3						
mean		1,178	3,429	1,349	477	1,388	546
SE		683	2,056	430	277	832	174
range		64-2,420	223-7,261	796-2,196	26-979	90-2,938	322-889
POTR/JUCO/CAGE	3						
mean		1,773	2,123	2,080	717	859	842
SE		1,662	2,123	484	672	859	196
range		64-5,096	0-6,370	1,433-3,024	26-2,062	0-2,578	580-1,224
POTR/POPR	8						
mean		585	936	2,194	237	379	888
SE		166	484	568	67	196	230
range		32-1,401	0-4,013	828-5,954	13-567	0-1,624	335-2,410
POTR/SYOR/POPR	11						
mean		1,485	1,691	1,784	601	684	722
SE		806	594	284	326	240	115
range		0-9,172	0-6,624	415-2,962	0-3,712	0-2,681	168-1,199
POTR/AMAL/THFE	4						
mean		6,791	6,067	3,414	2,748	2,455	1,382
SE		3,419	1,872	348	1,384	758	141
range		1,083-15,669	1,019-9,682	2,419-4,012	438-6,341	412-3,918	979-1,624
POTR/AMAL/TALL FORB	9						
mean		9,175	3,946	1,416	3,713	1,597	573
SE		5,902	1,304	180	2,388	528	73
range		255-55,287	64-11,210	763-2,357	103-22,374	26-4,537	309-954
POTR/AMAL-SYOR/BRCA	5						
mean		2,682	4,204	1,752	1,085	1,701	709
SE		1,618	3,230	358	655	1,307	145
range		32-8,917	32-17,070	1,018-3,120	13-3,609	13-6,908	412-1,263
POTR-ABLA/SYOR/ TALL FORB	4						
mean		653	1,154	1,727	264	467	699
SE		308	429	190	125	174	77
range		191-1,529	255-2,166	1,243-2,164	77-619	103-876	503-876
POTR-ABLA/THFE	16						
mean		1,312	1,642	1,598	531	665	647
SE		330	601	282	134	243	114
range		64-4,713	0-8,280	383-5,030	26-1,907	0-3,351	155-2,036
POTR-ABCO/SYOR	4						
mean		32	247	2,317	13	100	938
SE		32	247	371	13	100	150
range		0-127	0-987	1,337-2,992	0-52	0-400	541-1,211
Incidental community types							
POTR/VECA	1						
mean		2,038	3,694	988	825	1,495	400
SE		—	—	—	—	—	—
range		—	—	—	—	—	—

(con.)

APPENDIX J (Con.)

Community type	Stands in data base	Aspen reproduction		Tree density	Aspen reproduction		Tree density
		<3 dm	3-14 dm		<12 in	12-55 in	
		No./ha			No./acre		
POTR/RUPA	1						
mean		159	382	860	64	155	348
SE		—	—	—	—	—	—
range		—	—	—	—	—	—
POTR/SARA	6						
mean		632	1,088	1,374	256	440	556
SE		340	463	336	162	187	136
range		0-2,548	0-2,675	445-2,644	0-1,031	0-1,083	180-1,070
POTR/PTAQ	5						
mean		10,019	8,905	2,737	4,055	3,603	1,108
SE		7,254	6,127	1,097	2,936	2,479	444
range		223-37,899	127-31,816	828-6,305	90-15,337	52-2,479	335-2,552
POTR/AMAL/PTAQ	5						
mean		3,210	1,478	2,058	1,299	598	833
SE		1,465	741	576	593	300	233
range		64-8,662	255-4,395	670-4,109	26-3,506	103-1,779	271-1,663
POTR/FETH	6						
mean		1,109	2,341	2,653	449	947	1,074
SE		332	870	682	134	352	276
range		127-2,357	223-5,573	763-5,285	52-954	90-2,255	309-2,139
POTR/SYOR/FETH	1						
mean		191	573	1,816	77	232	735
SE		—	—	—	—	—	—
range		—	—	—	—	—	—
POTR/SYOR/CARO	3						
mean		425	2,877	2,229	172	1,164	902
SE		77	356	956	31	144	387
range			318-573	2,166-3,248	988-4,109	129-232	876-1,315
POTR/ASMI	3						
mean		998	658	2,261	404	266	915
SE		271	386	544	110	156	220
range		637-1,529	0-1,338	1,497-3,311	258-619	0-541	606-1,340
POTR/JUCO/ASMI	3						
mean		255	839	1,826	103	339	739
SE		146	728	220	59	294	89
range		64-541	64-2,293	1,433-2,196	26-219	26-928	580-889
POTR/JUCO/LUAR	1						
mean		1,147	96	988	464	39	400
SE		—	—	—	—	—	—
range		—	—	—	—	—	—
POTR/STCO	6						
mean		637	2,006	1,448	258	812	586
SE		177	871	188	72	353	76
range		32-1,274	32-5,924	670-1,974	13-516	13-2,397	271-799
POTR/SHCA	1						
mean		6,879	8,917	7,577	2,784	3,609	3,067
SE		—	—	—	—	—	—
range		—	—	—	—	—	—
POTR-ABLA/SHCA	1						
mean		541	32	1,910	219	13	773
SE		—	—	—	—	—	—
range		—	—	—	—	—	—
POTR-ABLA/AMAL	5						
mean		1,930	3,306	1,388	781	1,338	562
SE		1,653	1,770	316	669	716	128
range		64-8,535	96-8,153	702-2,483	26-3,454	39-3,299	284-1,005

(con.)

APPENDIX J (Con.)

Community type	Stands in data base	Aspen reproduction <3 dm	Aspen reproduction 3-14 dm	Tree density	Aspen reproduction <12 in	Aspen reproduction 12-55 in	Tree density
		No./ha	No./ha	No./ha	No./acre	No./acre	No./acre
POTR-ABLA/SYOR/BRCA	1						
mean		2,548	5,733	2,802	1,031	2,320	1,134
SE		—	—	—	—	—	—
range		—	—	—	—	—	—
POTR-ABLA/SYOR/THFE	4						
mean		605	1,346	2,429	245	545	983
SE		353	961	904	143	389	366
range		0-1,338	0-4,076	1,082-5,094	0-541	0-1,650	438-2,062
POTR-ABLA/JUCO	1						
mean		287	287	670	116	116	271
SE		—	—	—	—	—	—
range		—	—	—	—	—	—
POTR-ABLA/CAGE	5						
mean		783	796	2,083	317	322	843
SE		268	318	413	108	128	167
range		64-1,338	0-1,656	1,369-3,311	26-541	0-670	554-1,340
POTR-PICO/SYOR	2						
mean		271	2,213	3,454	110	896	1,398
SE		207	1,736	939	84	702	380
range		64-478	448-3,949	2,515-4,395	26-193	193-1,598	1,018-1,779
POTR-PICO/THFE	1						
mean		3,726	1,401	2,293	1,508	567	928
SE		—	—	—	—	—	—
range		—	—	—	—	—	—
POTR-PICO/CAGE	5						
mean		554	1,057	1,433	224	428	580
SE		114	438	430	46	177	174
range		255-892	96-2,611	413-2,992	103-361	39-1,057	167-1,211
POTR-PSME/AMAL	5						
mean		3,841	2,828	1,680	1,554	1,144	680
SE		1,915	1,824	425	775	738	172
range		255-10,573	318-9,936	445-2,962	103-4,279	129-4,021	180-1,199
POTR-PSME/SYOR	6						
mean		584	1,009	1,092	236	408	442
SE		196	297	84	79	120	34
range		96-1,274	127-2,293	763-1,369	39-516	52-928	309-554
POTR-PSME/JUCO	1						
mean		191	0	1,243	77	0	503
SE		—	—	—	—	—	—
range		—	—	—	—	—	—
POTR-PSME/CARU	1						
mean		3,376	1,274	1,401	1,366	516	567
SE		—	—	—	—	—	—
range		—	—	—	—	—	—
POTR-PIPO	3						
mean		393	1,051	1,868	159	425	756
SE		250	332	840	101	135	340
range		127-892	510-1,656	860-3,535	52-361	206-670	348-1,431
All stands	491						
mean		2,523	2,634	2,125	1,021	1,066	860
SE		257	194	77	104	79	31
range		0-61,625	0-31,816	222-17,257	0-24,938	0-12,875	90-6,985

APPENDIX K: PROPORTION OF YEARLY UNDERGROWTH PRODUCTION IN DIFFERENT VEGETATION CATEGORIES BY COMMUNITY TYPE, AND THE SUITABILITY OF THIS UNDERGROWTH AS LIVESTOCK FORAGE

Community type	Vegetation categories[1]			Forage suitability[2]		
	Shrubs	Forbs	Graminoids	Desirable	Intermediate	Least
	Percent					
Major community types						
POTR/TALL FORB	5	78	17	53	26	21
POTR/SYOR/TALL FORB	19	63	18	53	32	15
POTR/AMAL-SYOR/TALL FORB	27	48	25	54	40	6
POTR-ABLA/TALL FORB	5	77	18	43	30	27
POTR/CARU	2	39	59	67	31	2
POTR/SYOR/CARU	11	42	47	57	41	2
POTR/AMAL-SYOR/CARU	28	33	39	59	39	2
POTR/THFE	9	59	32	49	38	13
POTR/SYOR/THFE	17	42	41	45	51	4
POTR/AMAL-SYOR/THFE	28	35	37	50	47	3
POTR/CARO	3	34	63	70	28	2
POTR-ABLA/CARO	4	60	36	49	47	4
POTR/BRCA	1	47	52	41	45	14
POTR/SYOR/BRCA	14	47	39	42	46	12
Minor community types						
POTR/WYAM	1	89	10	39	28	33
POTR/ARTR	30	28	42	76	19	5
POTR/JUCO/CAGE	5	50	45	49	38	13
POTR/POPR	9	38	53	23	75	2
POTR/SYOR/POPR	22	38	40	28	63	9
POTR/AMAL/THFE	39	38	23	40	56	4
POTR/AMAL/TALL FORB	30	57	13	48	33	19
POTR/AMAL-SYOR/BRCA	12	62	26	50	48	2
POTR-PICO/JUCO	—	—	—	38	50	12
POTR-ABLA/SYOR/TALL FORB	23	46	31	56	35	9
POTR-ABLA/THFE	1	86	13	47	45	8
POTR-ABCO/SYOR	50	49	1	55	41	4
Incidental community types						
POTR/VECA	1	34	65	35	21	44
POTR/RUPA	87	10	3	85	14	1
POTR/SARA	42	42	16	66	22	12
POTR/PTAQ	2	91	7	28	21	51
POTR/AMAL/PTAQ	6	87	7	36	30	34
POTR/FETH	1	43	56	52	43	5
POTR/SYOR/FETH	40	40	20	52	40	8
POTR/SYOR/CARO	34	51	15	51	44	5
POTR/SYOR/WYAM	—	—	—	35	38	27
POTR/ASMI	11	74	15	26	37	37
POTR/JUCO/ASMI	11	64	25	27	48	2
POTR/JUCO/LUAR	35	25	40	41	46	13
POTR/STCO	2	45	53	59	38	3
POTR/SHCA	20	45	35	48	46	6
POTR-ABLA/SHCA	90	9	1	49	50	1
POTR-ABLA/AMAL	42	44	14	52	40	8
POTR-ABLA/SYOR/BRCA	—	—	—	40	46	14
POTR-ABLA/SYOR/THFE	14	81	5	60	39	1
POTR-ABLA/JUCO	35	62	3	51	48	1
POTR-ABLA/CAGE	2	55	43	55	41	4
POTR-PICO/SYOR	31	54	15	60	39	1
POTR-PICO/THFE	—	—	—	58	36	6
POTR-PICO/CAGE	3	60	37	61	34	5
POTR-PSME/AMAL	41	45	14	51	45	4
POTR-PSME/SYOR	11	39	50	55	38	7
POTR-PSME/JUCO	—	—	—	37	57	6
POTR-PSME/CARU	1	35	64	64	35	1

(con.)

APPENDIX K (Con.)

Community type	Vegetation categories[1]			Forage suitability[2]		
	Shrubs	Forbs	Graminoids	Desirable	Intermediate	Least
	Percent					
POTR-PIPO	23	38	39	58	39	3
POTR-ABCO/POPR	—	—	—	38	56	6
POTR-ABCO/ARPA	—	—	—	25	73	2
POTR-PIPU	—	—	—	44	49	7
POTR-PIFL	—	—	—	57	39	4
All stands	15	55	30	59	32	9

[1] Based on undergrowth weights from production plots.

[2] Based on proportionate canopy cover in suitability classes described by USDA Forest Service (1981).

APPENDIX L1: MEANS, STANDARD ERRORS, AND RANGES OF ANNUAL UNDERGROWTH PRODUCTION OF VEGETATION CLASSES BY ASPEN COMMUNITY TYPES, EXPRESSED IN DRY POUNDS PER ACRE

Community type	Stands in data base-vegetation classes	Shrubs	Forbs[1]	Graminoids	Annuals	Stands in data base-total production	Total lb/acre
		Lb/acre					
Major community types							
POTR/TALL FORB	63					88	
mean		51	862	192	57		1,107
SE		16	55	25	13		57
range		0-898	104-2,142	5-748	0-487		148-2,856
POTR/SYOR/TALL FORB	38					42	
mean		235	780	218	42		1,224
SE		45	75	39	7		82
range		7-1,505	169-2,092	7-1,127	0-206		494-2,462
POTR/AMAL-SYOR/TALL FORB	28					29	
mean		312	560	289	33		1,180
SE		41	52	73	12		64
range		40-798	61-1,329	0-1,875	0-347		824-2,344
POTR-ABLA/TALL FORB	16					30	
mean		38	555	130	39		917
SE		11	81	38	15		97
range		0-154	47-1,140	3-584	0-245		90-2,057
POTR/CARU	26					45	
mean		17	339	511	11		973
SE		4	58	54	1		59
range		0-104	43-1,324	70-1,113	0-41		373-1,892
POTR/SYOR/CARU	20					31	
mean		125	491	548	14		1,309
SE		31	69	82	3		107
range		13-543	151-1,295	46-1,297	0-46		310-2,721
POTR/AMAL-SYOR/CARU	32					37	
mean		257	314	362	18		1,107
SE		38	44	46	3		99
range		18-727	22-1,402	41-1,139	0-75		245-3,291
POTR/THFE	18					48	
mean		67	424	226	19		696
SE		27	78	54	7		63
range		4-482	41-1,279	3-684	0-108		152-2,549
POTR/SYOR/THFE	12					18	
mean		155	371	366	21		881
SE		35	51	115	7		83
range		26-377	180-747	6-1,032	0-97		427-1,659
POTR/AMAL-SYOR/THFE	5					7	
mean		281	345	366	24		1,099
SE		101	41	68	6		187
range		39-555	241-446	278-635	9-42		560-1,950
POTR/CARO	11					12	
mean		9	86	164	2		257
SE		2	19	51	1		52
range		2-19	4-204	8-515	0-6		78-606
POTR-ABLA/CARO	15					15	
mean		8	114	67	1		190
SE		4	27	22	1		43
range		0-67	131-439	1-262	0-6		4-563

(con.)

APPENDIX L1 (Con.)

Community type	Stands in data base-vegetation classes	Shrubs	Forbs	Graminoids	Annuals	Stands in data base-total production	Total lb/acre
		- - - - - - - -	- - - - *Lb/acre*	- - - - - - - -	- - - - - - - -		
POTR/BRCA	27					28	
mean		15	530	585	37		1,111
SE		4	59	61	17		74
range		0-96	63-1,190	41-1,202	0-482		403-1,922
POTR/SYOR/BRCA	10					10	
mean		138	475	395	13		1,008
SE		42	202	92	2		226
range		26-480	85-2,241	80-1,030	5-26		387-2,637
Minor community types							
POTR/WYAM	2					7	
mean		12	1,040	118	22		1,176
SE		1	44	76	9		58
range		10-13	996-1,084	42-194	13-31		945-1,322
POTR/ARTR	3					6	
mean		259	237	357	15		715
SE		112	110	109	7		100
range		44-421	18-366	187-562	7-28		248-936
POTR/JUCO/CAGE	3					3	
mean		31	321	390	7		667
SE		6	52	107	1		128
range		21-42	249-421	145-500	4-8		415-833
POTR/POPR	8					8	
mean		59	264	365	6		689
SE		33	102	51	1		105
range		0-268	8-876	167-595	0-10		303-1,289
POTR/SYOR/POPR	11					11	
mean		336	569	609	14		1,533
SE		93	126	103	3		204
range		23-1,142	132-1,416	175-1,227	0-25		654-2,537
POTR/AMAL/THFE	4					4	
mean		385	373	231	8		990
SE		145	83	114	3		21
range		157-792	141-496	9-523	0-10		942-1,046
POTR/AMAL/TALL FORB	9					9	
mean		336	629	138	42		1,103
SE		61	102	83	16		143
range		13-651	212-1,126	8-788	5-149		529-1,861
POTR/AMAL-SYOR/BRCA	4					4	
mean		132	696	292	12		1,120
SE		62	234	96	7		219
range		25-311	76-1,102	49-477	0-31		510-1,554
POTR-ABLA/SYOR/TALL FORB	3					4	
mean		238	479	329	19		910
SE		81	76	191	7		224
range		107-385	357-619	44-693	7-31		501-1,539
POTR-ABLA/THFE	12					18	
mean		6	431	65	9		496
SE		2	172	30	4		117
range		0-23	7-2,177	1-363	0-46		8-2,291
POTR-ABCO/SYOR	4					4	
mean		155	150	5	5		310
SE		45	81	1	4		63
range		69-275	15-385	2-7	0-18		188-458

(con.)

APPENDIX L1 (Con.)

Community type	Stands in data base-vegetation classes	Shrubs	Forbs	Graminoids	Annuals	Stands in data base-total production	Total lb/acre
		Lb/acre					
Incidental community types							
POTR/VECA	1					1	
mean		16	538	1,029	16		1,583
SE		—	—	—	—		—
range		—	—	—	—		—
POTR/RUPA	1					2	
mean		576	66	20	7		513
SE		—	—	—	—		149
range		—	—	—	—		364-662
POTR/SARA	6					6	
mean		470	482	178	90		1,130
SE		102	102	80	32		171
range		179-798	123-770	9-481	8-180		778-1,926
POTR/PTAQ	3					3	
mean		34	1,425	112	50		1,571
SE		18	435	58	44		375
range		10-69	829-2,271	0-197	0-138		1,037-2,294
POTR/AMAL/PTAQ	5					5	
mean		130	1,795	144	19		2,070
SE		100	499	94	6		515
range		16-530	787-3,569	8-493	0-38		837-3,796
POTR/FETH	6					6	
mean		10	460	594	7		1,064
SE		5	142	403	6		496
range		0-35	88-874	12-2,587	0-35		289-3,496
POTR/SYOR/FETH	1					1	
mean		310	310	155	8		775
SE		—	—	—	—		—
range		—	—	—	—		—
POTR/SYOR/CARO	3					4	
mean		254	371	113	7		673
SE		89	82	43	1		71
range		100-408	286-536	33-182	7-8		480-816
POTR/ASMI	3					5	
mean		34	227	45	4		395
SE		27	90	7	3		101
range		4-88	47-325	33-58	0-9		116-737
POTR/JUCO/ASMI	3					3	
mean		31	186	73	4		290
SE		14	114	37	3		136
range		7-55	53-412	4-133	0-11		88-549
POTR/JUCO/LUAR	1					2	
mean		259	185	296	7		766
SE		—	—	—	—		26
range		—	—	—	—		740-792
POTR/STCO	6					6	
mean		9	206	244	4		460
SE		3	92	56	2		78
range		3-26	7-486	26-356	0-10		319-823
POTR/SHCA	1					7	
mean		118	266	207	6		1,035
SE		—	—	—	—		183
range		—	—	—	—		592-2,053

(con.)

APPENDIX L1 (Con.)

Community type	Stands in data base-vegetation classes	Shrubs	Forbs	Graminoids	Annuals	Stands in data base-total production	Total lb/acre
		Lb/acre					
POTR-ABLA/SHCA	1					10	
mean		1,644	164	18	18		1,114
SE		—	—	—	—		196
range		—	—	—	—		532-2,473
POTR-ABLA/AMAL	5					6	
mean		476	506	162	57		1,162
SE		256	110	58	45		195
range		127-1,492	278-824	12-317	0-235		579-1,989
POTR-ABLA SYOR/BRCA	1					1	
mean		11	234	299	44		544
SE		—	—	—	—		—
range		—	—	—	—		—
POTR-ABLA/ SYOR/THFE	4					6	
mean		94	563	33	5		757
SE		67	164	25	2		123
range		22-294	172-939	2-108	0-11		203-1,080
POTR-ABLA/JUCO	1					1	
mean		90	160	8	3		258
SE		—	—	—	—		—
range		—	—	—	—		—
POTR-ABLA/CAGE	5					7	
mean		9	307	235	6		617
SE		2	52	88	2		83
range		6-15	205-506	31-492	0-12		310-946
POTR-PICO/SYOR	2					3	
mean		166	285	81	8		857
SE		9	154	50	1		329
range		157-175	131-439	31-131	6-9		438-1,506
POTR-PICO/CAGE	5					5	
mean		17	374	229	8		619
SE		5	120	79	2		90
range		6-33	15-660	100-524	3-13		291-825
PTOR/PSME/AMAL	5					6	
mean		341	380	121	6		922
SE		70	70	47	3		133
range		156-547	191-555	6-278	0-14		562-1,388
POTR-PSME/SYOR	5					7	
mean		98	358	458	13		1,257
SE		46	85	98	4		317
range		11-210	140-560	311-841	6-28		588-3,092
POTR-PSME/JUCO	1					1	
mean		9	281	6	0		295
SE		—	—	—	—		—
range		—	—	—	—		—
POTR-PSME/CARU	1					5	
mean		5	174	319	5		1,418
SE		—	—	—	—		369
range		—	—	—	—		498-2,610
POTR-PIPO	3					3	
mean		171	282	282	9		735
SE		42	137	21	6		185
range		86-214	64-534	248-320	0-21		428-1,068

(con.)

APPENDIX L1 (Con.)

Community type	Stands in data base-vegetation classes	Shrubs	Forbs	Graminoids	Annuals	Stands in data base-total production	Total lb/acre
		- - - - - - - -	- - - *Lb/acre*	- - - - - - - -			
All stands	(463)					633	
mean		139	519	288	26		976
SE		10	20	14	3		23
range		0-1,644	1-3,569	0-2,587	0-487		4-3,796

[1]Forb production includes production of annuals.

APPENDIX L2: MEANS, STANDARD ERRORS, AND RANGES OF ANNUAL UNDERGROWTH PRODUCTION OF VEGETATION CLASSES BY ASPEN COMMUNITY TYPES, EXPRESSED IN DRY WEIGHT KILOGRAMS PER HECTARE

Community type	Stands in data base-vegetation classes	Shrubs	Forbs[1]	Graminoids	Annuals	Stands in data base-total production	Total kg/ha
		- - - - - - - - - - - - - - - - - - -kg/ha	- - - - - - - - - - - - - - - - - -				
Major community types							
POTR/TALL FORB	63					88	
mean		57	967	216	64		1,240
SE		17	62	28	14		64
range		0-1,006	117-2,401	5-839	0-546		166-3,202
POTR/SYOR/TALL FORB	38					42	
mean		263	874	244	47		1,372
SE		50	84	43	8		92
range		8-1,687	190-2,346	8-1,264	0-231		554-2,760
POTR/AMAL-SYOR/TALL FORB	28					29	
mean		350	627	324	38		1,322
SE		45	58	81	14		72
range		45-894	68-1,490	0-2,102	0-390		924-2,627
POTR-ABLA/TALL FORB	16					30	
mean		43	622	146	44		1,028
SE		13	91	42	17		108
range		0-172	53-1,279	3-655	0-274		101-2,306
POTR/CARU	26					45	
mean		19	380	573	12		1,090
SE		5	64	60	2		66
range		0-117	48-1,485	79-1,246	0-46		418-2,121
POTR/SYOR/CARU	20					31	
mean		140	551	614	15		1,467
SE		35	77	92	3		120
range		15-609	169-1,452	52-1,454	0-52		347-3,050
POTR/AMAL-SYOR/CARU	32					37	
mean		289	352	406	20		1,241
SE		42	50	51	3		111
range		20-815	25-1,572	46-1,277	0-84		274-3,690
POTR/THFE	18					48	
mean		75	475	253	21		781
SE		31	87	61	8		70
range		4-540	46-1,433	4-767	0-121		170-2,858
POTR/SYOR/THFE	12					18	
mean		174	416	411	24		988
SE		39	57	129	8		93
range		29-423	202-837	6-1,157	0-108		479-1,860
POTR/AMAL-SYOR/THFE	5					7	
mean		315	387	411	27		1,232
SE		114	46	76	7		210
range		44-623	270-500	311-711	10-47		628-2,186
POTR/CARO	11					12	
mean		10	96	184	2		289
SE		2	21	57	1		58
range		2-21	4-229	9-577	0-7		88-679
POTR-ABLA/CARO	15					15	
mean		9	128	76	2		213
SE		5	31	25	1		49
range		0-75	1-410	2-294	0-6		4-632
POTR/BRCA	27					28	
mean		17	594	656	41		1,245
SE		4	66	68	19		83
range		0-108	71-1,334	46-1,348	0-541		452-2,155

(con.)

APPENDIX L2 (Con.)

Community type	Stands in data base-vegetation classes	Shrubs	Forbs[1]	Graminoids	Annuals	Stands in data base-total production	Total kg/ha
		kg/ha					
POTR/SYOR/BRCA	10					10	
mean		154	533	442	15		1,130
SE		47	227	103	3		254
range		29-538	95-2,513	90-1,155	5-30		434-2,956
Minor community types							
POTR/WYAM	2					7	
mean		13	1,166	132	25		1,319
SE		1	49	85	10		65
range		12-14	1,117-1,216	47-217	14-35		1,060-1,482
POTR/ARTR	3					6	
mean		290	266	400	17		802
SE		126	124	123	7		112
range		49-472	20-410	210-630	8-31		278-1,049
POTR/JUCO/CAGE	3					3	
mean		36	359	325	7		747
SE		7	58	120	1		143
range		23-47	279-472	163-560	5-9		465-934
POTR/POPR	8					8	
mean		66	296	409	7		772
SE		37	114	58	1		118
range		0-301	9-982	187-667	0-11		340-1,445
POTR/SYOR/POPR	11					11	
mean		377	638	683	16		1,719
SE		104	141	115	4		229
range		26-1,280	148-1,588	196-1,375	0-28		733-2,844
POTR/AMAL/THFE	4					4	
mean		432	418	259	8		1,109
SE		163	93	128	3		24
range		176-887	158-556	11-586	0-12		1,057-1,172
POTR/AMAL/TALL FORB	9					9	
mean		376	706	155	47		1,237
SE		69	114	93	18		161
range		15-730	237-1,263	9-883	6-167		593-2,087
POTR/AMAL-SYOR/BRCA	4					4	
mean		148	780	327	14		1,255
SE		70	262	107	8		246
range		29-348	86-1,235	55-534	0-35		572-1,742
POTR/ABLA/SYOR/TALL FORB	3					4	
mean		266	537	369	21		1,020
SE		90	85	214	8		251
range		120-431	400-694	50-776	8-35		562-1,725
POTR-ABLA/THFE	12					18	
mean		7	483	72	10		556
SE		2	193	34	4		131
range		0-26	8-2,440	1-407	0-51		8-2,568
POTR-ABCO/SYOR	4					4	
mean		174	168	5	6		348
SE		61	91	1	5		70
range		77-309	17-431	2-8	0-21		211-514
Incidental community types							
POTR/VECA	1					1	
mean		18	603	1154	18		1,775
SE		—	—	—	—		—
range		—	—	—	—		—

(con.)

Community type	Stands in data base-vegetation classes	Shrubs	Forbs[1]	Graminoids	Annuals	Stands in data base-total production	Total kg/ha
		kg/ha					
POTR/RUPA	1				2		
mean		646	74	22	7		575
SE		—	—	—	—		167
range		—	—	—	—		408-742
POTR/SARA	6					6	
mean		527	540	200	101		1,267
SE		115	114	90	36		192
range		201-895	138-864	10-540	9-201		872-2,159
POTR/PTAQ	3					3	
mean		38	1,598	125	56		1,762
SE		20	927	65	50		420
range		12-77	930-2,546	0-221	0-155		1,162-2,572
POTR/AMAL/PTAQ	5					5	
mean		146	2,012	162	21		2,320
SE		112	559	105	7		577
range		18-594	882-4,001	9-552	0-46		938-4,256
POTR/FETH	6					6	
mean		11	516	666	7		1,193
SE		6	159	451	6		556
range		0-39	99-980	13-2,900	0-39		324-3,919
POTR/SYOR/FETH	1					1	
mean		348	348	174	9		869
SE		—	—	—	—		—
range		—	—	—	—		—
POTR/SYOR/CARO	3					4	
mean		285	416	126	8		755
SE		100	92	48	1		79
range		113-457	320-600	38-204	8-9		538-915
POTR/ASMI	3					5	
mean		39	254	50	5		443
SE		30	101	8	3		113
range		4-99	52-365	36-65	0-10		130-826
POTR/JUCO/ASMI	3					3	
mean		35	208	82	5		325
SE		16	127	42	4		153
range		8-62	59-462	5-149	0-12		98-616
POTR/JUCO/LUAR	1					2	
mean		290	207	332	8		859
SE		—	—	—	—		29
range		—	—	—	—		830-888
POTR/STCO	6					6	
mean		10	231	274	5		516
SE		4	103	63	2		87
range		4-29	8-545	29-399	0-12		358-923
POTR/SHCA	1					1	
mean		133	299	232	7		1,161
SE		—	—	—	—		206
range		—	—	—	—		664-2,302
POTR-ABLA/SHCA	1					10	
mean		1,843	184	20	20		1,249
SE		—	—	—	—		220
range		—	—	—	—		596-2,772
POTR-ABLA/AMAL	5					6	
mean		533	567	182	64		1,303
SE		287	123	65	50		218
range		142-1,672	312-924	13-355	0-264		649-2,229

(con.)

APPENDIX L2 (Con.)

Community type	Stands in data base-vegetation classes	Shrubs	Forbs[1]	Graminoids	Annuals	Stands in data base-total production	Total kg/ha
		- - - - - - - -	kg/ha	- - - - - - - -			
POTR-ABLA/SYOR/BRCA	1					1	
mean		12	262	335	49		610
SE		—	—	—	—		—
range		—	—	—	—		—
POTR-ABLA/SYOR/THFE	4					6	
mean		106	631	37	6		849
SE		75	184	28	3		138
range		24-330	193-1,053	2-121	0-12		227-1,210
POTR-ABLA/JUCO	1					1	
mean		101	179	9	3		289
SE		—	—	—	—		—
range		—	—	—	—		—
POTR-ABLA/CAGE	5					7	
mean		10	344	264	7		692
SE		2	58	99	2		93
range		7-17	230-567	35-551	0-13		347-1,060
POTR-PICO/SYOR	2					3	
mean		186	320	91	8		961
SE		10	173	56	1		
range		176-196	147-492	35-147	7-10		491-1,688
POTR-PICO/CAGE	5					5	
mean		19	419	256	8		694
SE		6	134	88	2		100
range		7-37	16-740	112-587	3-15		326-925
POTR-PSME/AMAL	5					6	
mean		382	426	136	7		1,034
SE		78	78	53	3		149
range		173-613	214-622	6-311	0-16		629-1556
POTR-PSME/SYOR	5					7	
mean		110	401	513	14		1,409
SE		51	95	110	4		356
range		13-236	156-628	349-943	6-31		626-3,466
POTR-PSME/JUCO	1					1	
mean		10	315	7	0		331
SE		—	—	—	—		—
range		—	—	—	—		—
POTR-PSME/CARU	1					5	
mean		6	196	358	6		1,590
SE		—	—	—	—		414
range		—	—	—	—		559-2,926
POTR-PIPO	3					3	
mean		191	316	316	11		824
SE		48	153	24	7		208
range		96-240	72-599	278-359	0-24		480-1,198
All stands	(463)					633	
mean		156	581	323	30		1,095
SE		11	23	16	3		25
range		0-1,843	1-4,001	0-2,900	0-546		4-4,256

[1] Forb production includes production of annuals.

APPENDIX M: ASPEN COMMUNITY TYPE FIELD FORM FOR INTERMOUNTAIN REGION

STUDY: **DATE:** **EXAMINER:**

CANOPY COVER ESTIMATES:

Estimate cover of each species as:
-trace(T) if less than 0.5%
-to nearest 1% if less than 10%
-to nearest 5% if over 10%

Estimate cover of trees (over 1.4 m high) and reproduction (less than 1.4 m high) separately (e.g. 40/5).

TOPOGRAPHY:

1-Ridge 4-Lower slope
2-Upper slope 5-Bench/flat
3-Mid slope 6-Stream bottom

CONFIGURATION:

1-Convex 3-Concave
2-Straight 4-Undulate

Plot No.				
Meridan				
T,R,S				
Elevation				
Aspect				
% slope				
Configur.				
Other:				

Scientific Name	Abbreviation	Common Name	Canopy Cover			
TREES						
Abies concolor	ABCO	white fir	/	/	/	/
Abies lasiocarpa	ABLA	subalpine fir	/	/	/	/
Picea engelmannii	PIEN	Engelmann spruce	/	/	/	/
Picea pungens	PIPU	blue spruce	/	/	/	/
Pinus contorta	PICO	lodgepole pine	/	/	/	/
Pinus flexilis	PIFL	limber pine	/	/	/	/
Pinus ponderosa	PIPO	ponderosa pine	/	/	/	/
Populus tremuloides	POTR	quaking aspen	/	/	/	/
Pseudotsuga menziesii	PSME	Douglas-fir	/	/	/	/
SHRUBS						
Acer grandidentatum	ACGR	canyon maple				
Amelanchier alnifolia	AMAL	western serviceberry				
Arctostaphylos patula	ARPA	greenleaf manzanita				
Artemisia tridentata	ARTR	big sagebrush				
Juniperus communis	JUCO	common juniper				
Pachistima myrsinites	PAMY	myrtle pachystima				
Prunus virginiana	PRVI	chokecherry				
Rosa spp.	ROSA	rose				
Rubus parviflorus	RUPA	thimbleberry				
Salix scouleriana	SASC	Scouler willow				
Sambucus spp.	SAMB	elderberry				
Shepherdia canadensis	SHCA	russet buffaloberry				
Spiraea betulifolia	SPBE	white spirea				
Symphoricarpos oreophilus	SYOR	mountain snowberry				
GRAMINOIDS						
Agropyron trachycaulum	AGTR	slender wheatgrass				
Bromus anomalus	BRAN	nodding brome				
Bromus carinatus	BRCA	mountain brome				
Calamagrostis rubescens	CARU	pinegrass				
Carex geyeri	CAGE	elk sedge				
Carex rossii	CARO	Ross sedge				
Elymus glaucus	ELGL	blue wildrye				
Festuca idahoensis	FEID	Idaho fescue				
Festuca thurberi	FETH	Thurber fescue				
Poa pratensis	POPR	Kentucky bluegrass				
Sitanion hysterix	SIHY	bottlebrush squirreltail				
Stipa comata	STCO	needle-and-thread				
FORBS						
Agastache urticifolia	AGUR	nettleleaf giant hyssop				
Aster engelmannii	ASEN	Engelmann aster				
Astragalus miser	ASMI	weedy milkvetch				
Delphinium occidentale	DEOC	duncecap larkspur				
Geranium viscosissimum	GEVI	sticky geranium				
Hackelia floribunda	HAFL	showy stickseed				
Heracleum lanatum	HELA	common cowparsnip				
Lupinus argenteus	LUAR	silvery lupine				
Mertensia arizonica	MEAR	tall bluebell				
Osmorhiza chilensis	OSCH	sweetroot				
Osmorhiza occidentalis	OSOC	sweetanise				
Pteridium aquilinum	PTAQ	brakenfern				
Rudbeckia occidentalis	RUOC	western coneflower				
Senecio serra	SESE	butterweed groundsel				
Thalictrum fendleri	THFE	Fendler meadowrue				
Valeriana occidentalis	VAOC	western valerian				
Veratrum californicum	VECA	California false-hellebore				
Wyethia amplexicaulis	WYAM	mulesear wyethia				

COVER TYPE				
COMMUNITY TYPE				

Mueggler, Walter F. 1988. Aspen community types of the Intermountain Region. Gen. Tech. Rep. INT-250. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 135 p.

This vegetation classification is based upon existing community structure and composition in the aspen-dominated forests of the Intermountain Region of the Forest Service. The 56 community types occur within eight tree-cover types. A diagnostic key using indicator species facilitates field identification of the community types. Vegetational composition, productivity, and successional status are included. Tables provide detailed comparisons of community types. The classification and descriptions are based upon field data from over 2,100 aspen stands scattered over southeastern Idaho, western Wyoming, Utah, and Nevada.

KEYWORDS: aspen forests, community types, plant communities, forest ecology, classification, Utah, Nevada, Idaho, Wyoming

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